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Current Account Determination in the Eurozone

A thesis submitted in partial fulfillment of the requirement
for the degree of Bachelor of Arts in Economics from
The College of William and Mary

by
Amy Filipek

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April 20, 2012

Current Account Determination in the Eurozone

Amy Filipek

Economics Department Honors Thesis

Spring 2012

I. Introduction

While the eurozone's aggregate current account balance has remained near zero since its conception in 1999, the current accounts of individual members have been remarkably divergent. The peripheral or southern countries (Greece, Spain, Portugal, Ireland, and Italy) have run current account deficits approaching double digits and the core or northern countries (Germany, France, Netherlands, Finland, Austria, and Belgium) have run correspondingly large surpluses. However, the annual growth of the imbalances over time is more alarming than the size of the deficits or surpluses themselves. In 1997, the range was less than 10 percent of GDP; ten years later, the range was over 20 percent. When the 2007 financial crisis hit, investors questioned the creditworthiness of peripheral countries that had accumulated massive foreign debt from more than a decade of persistent current account deficits (see Bernoth and Erdogan, 2010). Triggered by this lost investor confidence, the risk premia demanded by holders of public debt rapidly increased for peripheral countries. The yield spread on 10-year government Irish bonds relative to German bunds stood at 567 basis points as of January 2012, compared to 24 basis points in

2000 (see Dailami, 2012). As a result of their unprecedented borrowing costs, peripheral countries' governments could not roll-over their debt, and the EMU and the IMF were forced to bail out Greece, Ireland, and Portugal in 2010 and 2011. Even though the current account imbalances have been reduced by an average of 3 percent each year since 2007, there is reason to believe that their narrowing is almost entirely the result of the global recession temporarily reducing domestic demand and imports in the peripheral countries. Gagnon (2011) predicts that over the next 5 years, current account imbalances will return to record pre-crisis levels. While persistent current account deficits certainly contributed to the severity of the financial crisis in the eurozone by intensifying investor fears, it is important to determine to what extent the pre-crisis current account imbalances were caused by improper macroeconomic management. If any structural imbalances are found, a policy priority for the eurozone must be to correct them; only by making such appropriate adjustments to the private and public sector can member countries hope to prevent the resurgence of the current account imbalances and investors' fears once the macroeconomic conditions normalize.

The aim of this paper is to identify the economic, financial, and other factors that influence the current account balances of the eurozone countries and determine to what extent external imbalances are driven by the same set of factors across multiple member countries. The analysis is guided by the intertemporal approach and treats the current account as the outcome of national saving and investment decisions. It uses quarterly panel data to investigate the determinants of 11 members of the eurozone's current account balance over the last 15 years. I use a dynamic panel system-GMM and country-specific VARs. Most notably, from the system-GMM regression, I find government savings and real per-capita income to have a significant positive relationship with the current account—.19 and .52 respectively—and the real exchange

rate and gross fixed capital investment to have a significant negative relationship— -8.2 and .32 respectively. The impulse response functions from my VAR model, suggest that real GDP growth and gross fixed capital investment have the most significant effect on current account balances of peripheral members (peaking at about -.7 and -1 respectively), while government savings and real GDP growth have the most significant effect on core members (peaking at about .2 and -.6 respectively).

This paper is organized as follows: first, I will consider relevant economic theory of the factors that drive current account balances; second, I will review the current financial crisis as it has impacted the eurozone and discuss some stylized facts about individual eurozone members; third, I will survey the literature; fourth, I will specify the variables and models that I will use; fifth, I will examine my system-GMM model; sixth, I will review my VAR model; seventh, I will compare my panel and time-series results; finally, I will conclude with my policy recommendations.

II. Current Account Determinants

i. Financial Integration

There is no reason for current accounts to be balanced in the short run. Neither deficits nor surpluses are *prima facie* good or bad (see Taylor 2002). They can simply be the result of allocating savings to where it is most productive. Thus, requiring countries to maintain balanced current accounts in all circumstances reduces the benefits of inter-temporal trade and prevents the international flow of capital to the most profitable investments. The adoption of a common currency affects the optimal capital allocation within a currency union because it eliminates

exchange rate risk for investments made between member countries. While all member countries experience lower real interest rates as a result of joining, low-income countries with high inflation benefit the most because their exchange rate risk was higher before joining. The fall of real interest rates fosters private investment and reduces private savings, especially where the fall is greatest. Additionally, if low-income countries experienced dramatically improved access to external financing as a result of joining the union, then their current account deficits should become more persistent. Thus, large current account imbalances can emerge naturally within a currency union as a result of changes to investment and savings behavior. Accordingly, as long as eurozone imbalances reflect the optimal allocation of capital, they merely signal the proper functioning of the capital market and increased financial integration between members (see Ahern *et al.*, 2008).

Nonetheless, as laid out by Jaumotte and Sodsriwiboon (2010), current account imbalances that are not fully justified by these kinds of optimal savings decisions can be extremely destructive even within a currency union. First, the imbalances may reflect harmful underlying domestic distortions that need to be corrected (see Blanchard, 2007; Blanchard and Milesi-Ferretti, 2009). Blanchard argued that this occurred in Spain, which had low net savings resulting from transitory booms in asset prices, and Portugal, which had excessively optimistic expectations about future growth, in the late 1990s. Second, economic theory dictates that the current account will be balanced in the long run, meaning that all countries running imbalances in the short run will have to undergo adjustments in the medium run to eventually achieve this. This gradual adjustment is painful. This process would be especially painful in the eurozone since the exchange rate between members is fixed, labor mobility is limited, and fiscal power is at the country level. Thus, in the eurozone, imbalances caused by underlying structural

problems—like competitiveness or overheating—would necessitate a protracted period of low growth to achieve long-run balance, since member governments cannot control their exchange rate, labor is virtually immobile across countries, and fiscal policy coordination between governments is limited. Finally, the long run adjustment toward balanced current accounts may be abrupt rather than gradual. If financing suddenly stops or becomes expensive, countries with large current account deficits are forced to deleverage intensely, causing a sharp contraction of domestic demand (see Gourinchas and Torrnell, 2002). This becomes especially serious if the rapid credit growth underlying the current account deficit is associated with lower average loan quality in the banking sector. In this scenario, the economy would contract as a result of the abrupt reduction of financing and the overwhelming number of nonperforming loans on the asset side of the banking sector. In summary, even though financial integration is likely partially responsible for the eurozone's current account imbalances, it is important to carefully examine the imbalances to ensure that underlying structural distortions are not contributing to the imbalances since correcting such imbalances is virtually guaranteed to be painful.

ii. Government Savings

The first potential domestic distortion I will examine arises from excessive fiscal positions. Most simply, an accounting framework suggests that *ceteris paribus*, an increase in the government deficit must be matched by an increase of the current account deficit; this relationship is called the twin deficit hypothesis (see Equation 1). However, this framework is too basic. It makes the simplifying assumption that private savings and investment are unaffected by the change in government savings. This equation also fails to explain the direction of the

causality; does the current account affect government savings or does government savings affect the current account?

$$\begin{aligned} 1. \quad \text{Current Account} &= \text{Saving} - \text{Investment} + \text{Statistical Discrepancy} \\ &= \text{Private Savings} + \text{Net Government Savings} - \text{Investment} \\ &= \text{Private Savings} - \text{Government Primary Budget Deficit} + \\ &\quad \text{Government Net Interest Receipts} - \text{Investment} + \text{Statistical Discrepancy} \end{aligned}$$

The intuition of the twin deficit hypothesis is supported by some economic theory. It is a major result of the static Mundell-Fleming model for a country with a flexible or fixed exchange rate, as long as it is assumed that both consumption and the current account balance are a function of contemporary income. In a flexible exchange rate system, a fiscal expansion raises the domestic interest rate above the world interest rate. The interest rate differential incurs capital inflows, which appreciates the real exchange rate. This leads to a trade deficit that fully crowds out the initial fiscal expansion. The multi-country Mundell-Fleming model with a fixed exchange rate peg between members and perfect capital mobility is more complicated. A fiscal expansion stimulates domestic activities and pressures the exchange rate to appreciate and the domestic interest rate to increase. However, in a currency union, the exchange rate between members is fixed, and the interest rate is determined at the union level. Thus, for a small country (or a small fiscal expansion), the union interest rate is fixed. As a result, domestic money under circulation increases and domestic output is further stimulated. This increase in income raises aggregate consumption, some of which will be spent on imports. Hence, the domestic trade deficit increases. If the country (or the fiscal expansion) is large enough, negative spillovers to other union members occur. In this scenario, the initial increase in the domestic interest rate following the fiscal expansion attracts sizeable capital inflows that put upward pressure on the interest rates of the other members. As a result, the final union interest rate may be higher than the initial rate.

If this is the case, output in the union would contract. However, as in the flexible exchange rate scenario, as long as inflation is contained, the increase in the union interest rate would cause an appreciation of the union real exchange rate and would worsen the union's trade balance.

Home-bias is another common argument used to support the theory that fiscal expansion causes the real exchange rate to appreciate and subsequently the current account balance to deteriorate. Frankel, Razin, and Yuen (1996) argue that insofar as government spending concentrates on home-produced goods, fiscal expansions should make these goods relatively scarcer, thereby increasing their relative price with respect to imported goods and leading to a real appreciation.

In contrast to the Mundell-Fleming model and the home-bias theory, the Ricardian equivalence theorem argues that there is no relationship between government savings and current account balance. The twin deficit hypothesis rests on the assumption that the relationship between fiscal deficits and private consumption is a positive one, meaning that when the government collects less taxes revenue, private consumption increases. However, this is not necessarily true. The Ricardian equivalence theorem states that for a given path of government expenditures, the timing of taxes should not affect the consumption decisions made by tax-paying individuals because rational agents realize that governments will have to balance their debt in the long run. Thus, taxes today and taxes plus the accumulated interest tomorrow are the same (see Barro, 1974). Proponents of the theorem argue in direct contrast to the Mundell-Fleming model that consumers will not alter their consumption decisions as a result of fiscal transfers. Instead, they believe individuals save the entire transfer to pay the government in the future when it raises or lowers their taxes by the amount of the transfer. Hence, proponents argue that government spending has no effect on the current account balance.

iii. Per-capita income

Next, I will examine the implications of the convergence hypothesis (also known as the catch-up effect) for the current account balance. Standard economic theory states that countries with relatively low per-capita income and capital stock will have greater marginal returns to capital than relatively wealthy countries. This relatively high return will attract capital inflows and raise external indebtedness in the short run. Over time the poorer country's return to capital will converge to the world rate and capital inflows will slow. Therefore, in the long run, economic theory dictates that the poorer countries, through greater capital inflows and technological utilization, will catch-up to nations with relatively high income on a per-capita basis. Knowing this, consumers in poorer economies can rationally anticipate real convergence and a higher income in the future. They can make their real consumption in the present and the future the same by taking on debt in the present and paying it off in the future; this is called consumption-smoothing. Since some proportion of this borrowed consumption in the present and forgone consumption in the future will be spent on foreign imports, current account deficits are expected in the present, but will naturally correct themselves over time. However, consumption smoothing is only justified if the poorer countries actually reach the expected per-capita income level in the future. Thus, the convergence hypothesis predicts that poorer countries should exhibit greater per-capita income growth and current account deficits in the short run, and that they will self-correct over time, as long as growth forecasts are realized. However, overly optimistic real per-capita income forecasts would signal a structural imbalance and the current account deficit would not naturally become balanced over time.

A supporting rationale for the convergence theory is the convergence club theory, which is particularly apt when members of a currency union exhibit a wide disparity in per-capita income. It states that convergence is driven by productivity-enhancing spillovers from the core to the periphery as the converging economies develop extensive trade and financial linkages with the core (see Baumol *et al.*, 1986). Further, since productivity is growing fast in the periphery relative to the core, and the currency cannot adjust to reflect this difference between members, current account deficits are the periphery's only recourse for adjustment. In other words, this theory predicts that since joining a currency union deepens the financial linkages between the member countries, the speed of convergence between the core and the periphery will be fastest when the per-capita income gap is largest and that current account deficits naturally result in the periphery.

iv. Real Exchange Rate

Finally, I will explore the hypothesis with the most severe implications for members of a currency union; the competitiveness hypothesis (also known as the “ability to sell” hypothesis) argues that when the real exchange rate appreciates, domestic demand for goods is reduced and demand for foreign goods is increased. In other words, if domestic goods are in some way better—say cheaper—than foreign goods, then foreigners should import more than they export and domestic residents should export more than they import. Thus, current account surpluses are an indicator of superior competitiveness and deficits are an indicator of economic weakness. In the case of a common currency, fluctuations in the real exchange rate correspond to changes in relative prices. Most commonly, a lack of competitiveness in a currency union stems from

domestic prices being higher than foreign prices because domestic workers' nominal wages are too high, given their labor productivity.

Even in the long run, differences in competitiveness within a currency area fail to adjust themselves. Left unchecked the competitiveness gap and current account divergences between members continue to grow; thus, it is important to determine if one exists and correct the underlying structural distortion as soon as possible (see Arghyrou and Chortareas, 2008). In a currency union, given that devaluation is not possible, fiscal policy is determined at a domestic level, and monetary policy is determined at a union level, adjustment to close the competitiveness gap must come through the labor market. The required adjustment by the surplus countries is inflationary (to stimulate their demand and imports and to increase their unit costs), whereas the adjustment by the deficit countries is deflationary (to dampen demand and imports and lower their unit prices). However, in the eurozone, the burden of adjustment effectively falls on the country with the current account deficit. The European Central Bank (ECB) is committed to a low inflation target, meaning that an inflationary adjustment (as would be needed by surplus countries) is unlikely since it would be counteracted by monetary policy. Thus, if there is a competitive gap in the eurozone, closing it would necessitate countries with current account deficits undergoing extremely painful deflation, while surplus countries do nothing. This free-rider problem will be discussed in context to the eurozone in the following section.

III. Stylized Facts

In this section, I will outline major elements of the recent financial crisis and present the major stylized facts for individual members of the eurozone and the eurozone as a whole, which motivate this paper. On January 1, 1999, the euro currency officially came into existence, although the coins and the notes were introduced three years later. The original members of the eurozone were Austria, Belgium, Finland, France, Germany, Luxemburg, and the Netherlands (“the core”) and Ireland, Italy, Portugal, and Spain (“the periphery”). Greece was admitted into the eurozone in 2001. Because Luxemburg is missing significant data and is an outlier in the eurozone in terms of its low population and high per-capita income, I will focus on the aforementioned 11 other eurozone member countries in my discussion and data analysis.

It is important to discuss how the 2007 global financial crisis, from which the eurozone economy entered its steepest downturn since the 1930’s, impacted individual member states. In this section, I hope to identify basic trends among the core and peripheral countries that will supply context to my empirical analysis in later sections. In its early stages, the crisis manifested itself in the eurozone as an acute liquidity shortage among financial institutions because it became more difficult for governments to roll-over their short-term debt. In 2007, concerns over the solvency of financial institutions were mounting, but a systemic collapse was deemed unlikely. This changed on September 15, 2008, when the fourth largest investment bank in America declared bankruptcy. Immediately following Lehman Brothers’ bankruptcy, confidence collapsed, investors massively liquidated their positions, and stock markets went into a tailspin. The lost confidence reduced business investment and household demand, which transmitted quickly to the global real economy. In December 2008, EU leaders agreed to a 200bn-euro stimulus plan to boost European growth following the crisis. In April 2009, the EU ordered France, Spain, Ireland, and Greece to reduce their budget deficits. Investor concerns continued to

mount following the Dubai sovereign debt crisis in November. In December, Greece admitted that its government debt has reached 113 percent of GDP (or 300bn euros). Consequentially, ratings agencies began downgrading Greek bank and government debt.

In January 2010, after EU officials examined Greece's budget records, its government deficit for 2009 was revised upwards from 3.7 to 12.7 percent. To reduce their deficit, Greece unveiled austerity measures in February. Eurozone members pledged to provide up to 30bn euros in emergency loans in April following rising investor concerns about heavily indebted countries, namely Portugal, Ireland, Greece, and Spain. Nonetheless, Greek borrowing costs continued to reach record highs. Finally, on May 2, the eurozone members and the IMF agreed to an 110bn-euro bailout package to rescue Greece. However, the euro continued to fall and investors next lost confidence in Irish debt. In November, the EU and IMF were forced to agree to an 85bn-euro bailout package for Ireland.

In February 2011, eurozone finance ministers set up a permanent bailout fund, called the European Stability Mechanism, worth about 500bn euros. Nonetheless, investor scrutiny next turned to Portugal. By May, the eurozone and the IMF approved a 78bn-euro bailout for Portugal. Greece's situation also continued to worsen and they received a second 109bn-euro bailout in July. By August, the yields on government bonds from Spain and Italy had risen sharply. On August 7, the ECB announced it would buy Italian and Spanish government bonds. To further alleviate investor concerns, Spain passed a constitutional amendment to add a "golden rule" that will severely restrict all future budget deficits, and Italy passed an austerity budget that will allow Italy to run a balanced budget in 2013. Nonetheless, Italy's debt rating was cut by Standard & Poor's. On October 21, finance ministers approved the next tranche of Greek bailout loans, which again saved the country from default.

In January 2012, Standard & Poor's downgraded France, Austria, Italy, Portugal, Spain, and the EU bailout fund. Also, the Fiscal Pact, which will make it harder for members to run budget deficits in the future, was signed by 25 EU members. In February, Greece passed another unpopular austerity bill. In return, eurozone countries agreed to give Greece the 130bn euros needed for the country to refinance loans. In March, Greece announced the results of their bond swap offer; banks agreed to write off 75 percent of the value of their loans. The eurozone's future, while still bleak, is expected to improve relative to 2011. As of its February 2012 interim report, the EU Commission forecasts that the eurozone economy as a whole will shrink 0.3 percent in 2012. Of note, they expect GDP in Finland (0.8 percent), Austria (0.7 percent), Germany (0.6 percent), France (0.4 percent), and Ireland (.5 percent) to grow and Greece (-4.4 percent), Portugal (-3.3 percent), Italy (-1.3 percent), Spain (-1 percent), Netherlands (-0.9 percent), and Belgium (-0.1 percent) to shrink.

Figures 1a and 1b show real GDP growth as a percent change from the previous year by core and peripheral eurozone countries since 1996. The nosedives experienced from 2007-2010 are dramatic. However, most strikingly, the countries that experienced sovereign debt crises in 2010 and 2011—notably Greece, Ireland, and Portugal—were the best performers within the eurozone in terms of economic growth over the decade preceding their bailouts. Indeed, Ireland, which was averaging over 7 percent real growth a year, was called the “Celtic Tiger”, in allusion to the fast-growing “Asian Tigers” from earlier decades. In contrast, the core countries that bailed them out averaged closer to 3 percent growth a year before the crisis. Though Finland, who experienced the greatest pre-crisis growth of the core countries, also experienced the most severe loss of growth in 2009 (-8.4 percent). While *prima facie* a paradox, the relationship between strong pre-crisis growth and the severity of the crisis has important implications about

the underlying economic, structural and institutional weaknesses that lie at the heart at the eurozone crisis. I will continue to examine these factors, and others, throughout this section.

Figure 1a: Annual Real GDP Growth for Core Eurozone Members in percentage change.

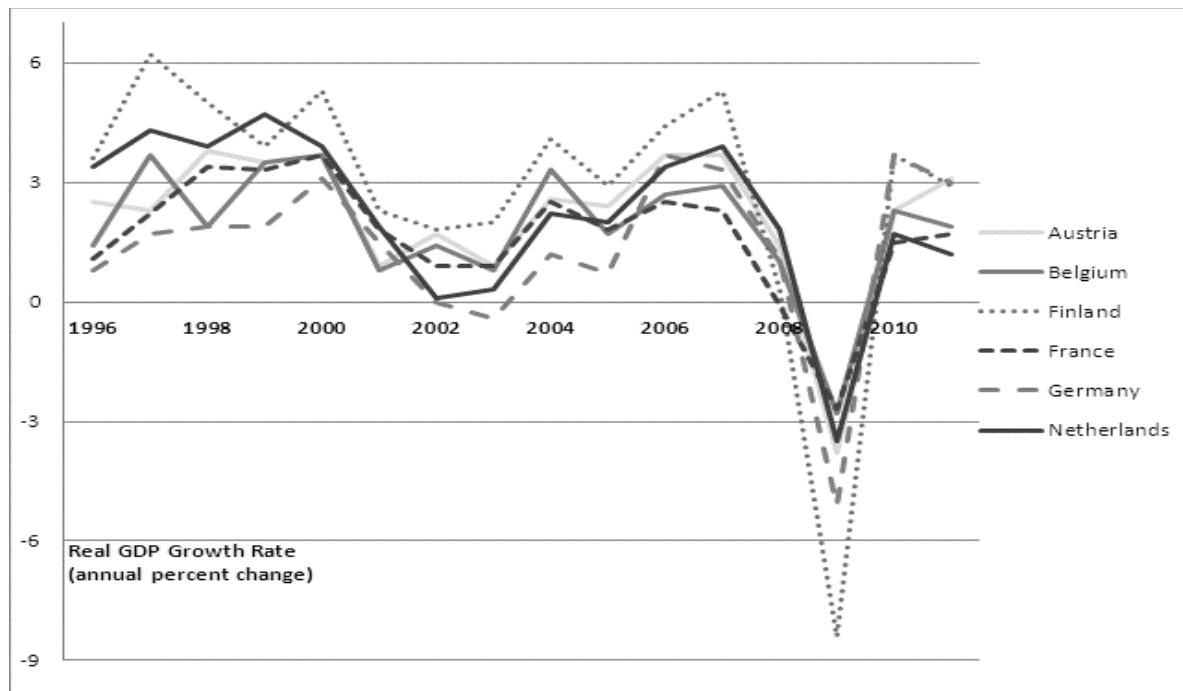
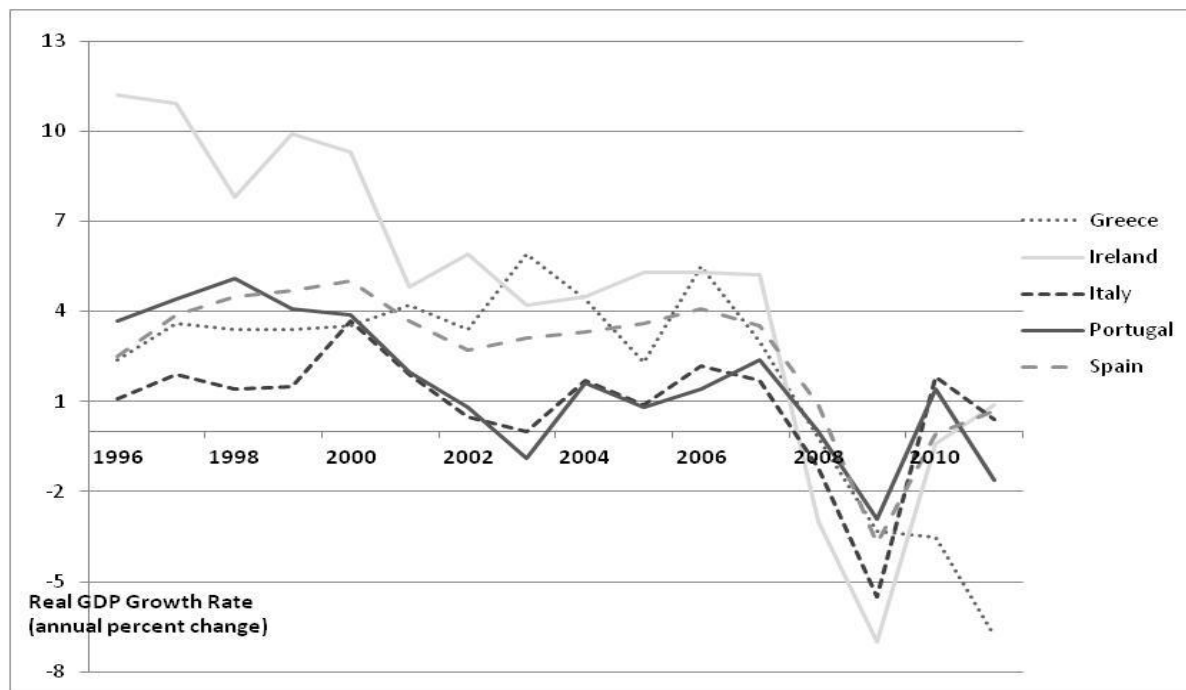


Figure 1b: Annual Real GDP Growth for Peripheral Eurozone Members in percentage change.



Source: Eurostat.

To begin, I will discuss the current account balances. As a whole, the eurozone has maintained a balanced current account position since adopting the euro. Germany (185bn-euros, 7.5 percent), Netherlands (39B bn-euros, 6.7 percent), Austria (10 bn-euros, 3.5 percent), Finland (8 bn-euros, 4.3 percent), and Belgium (6 bn-euros, 1.6 percent) had record high current account surpluses in 2007, while Spain (-106 bn-euros, -10 percent), Italy (-38 bn-euros, -1.3 percent), Greece (-33 bn-euros, -14.6 percent), France (-19 bn-euros, -1 percent), Portugal (-17 bn-euros, -10.1 percent), and Ireland (-10 bn-euros, -5.3 percent) had record high deficits in 2007. Despite these large individual imbalances, the eurozone experienced only a small surplus (28 bn-euros, 0.1 percent).¹ Figures 2a and 2b show the core and peripheral countries' current account balances as a percent of GDP from 1994-2011. Overall, peripheral countries have been running current account deficits and core countries have been running surpluses. As discussed in the Current Account Determination section, this is not necessarily a cause for concern. The growth of the imbalances over time, especially by the peripheral countries, is potentially more alarming. Overall, the standard deviation for current account balances for these 11 eurozone members grew from less than 4 percent of GDP in 1994 to over 10 percent in 2007. In particular, Ireland, Greece, and Portugal experienced at least a 7 percent deterioration of their current account balances from 1995 to 2007. Both trends could be the natural result of the convergence process or financial integration, but they could also signal harmful structural fiscal or competitiveness imbalances. While the gap has since closed, there is reason to believe it will return once the recession ends and demand returns to pre-crisis levels. Gagnon (2011) argues that current account imbalances are likely to return to record levels over the next five years since their abatement is a result of reduced global demand, rather than correcting the underlying causes. Thus, it is important to identify any structural distortions and correct them before they return.

¹ Eurostat

Figure 2a: Annual Current Account Balances for the Core Eurozone members in percentage of GDP.

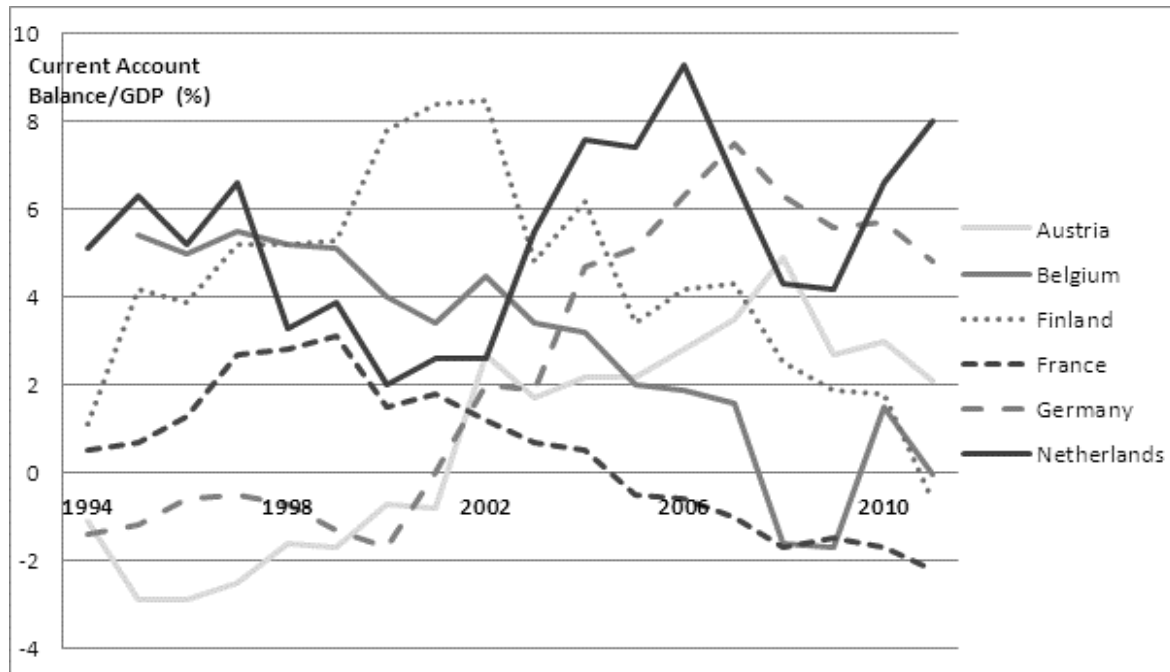
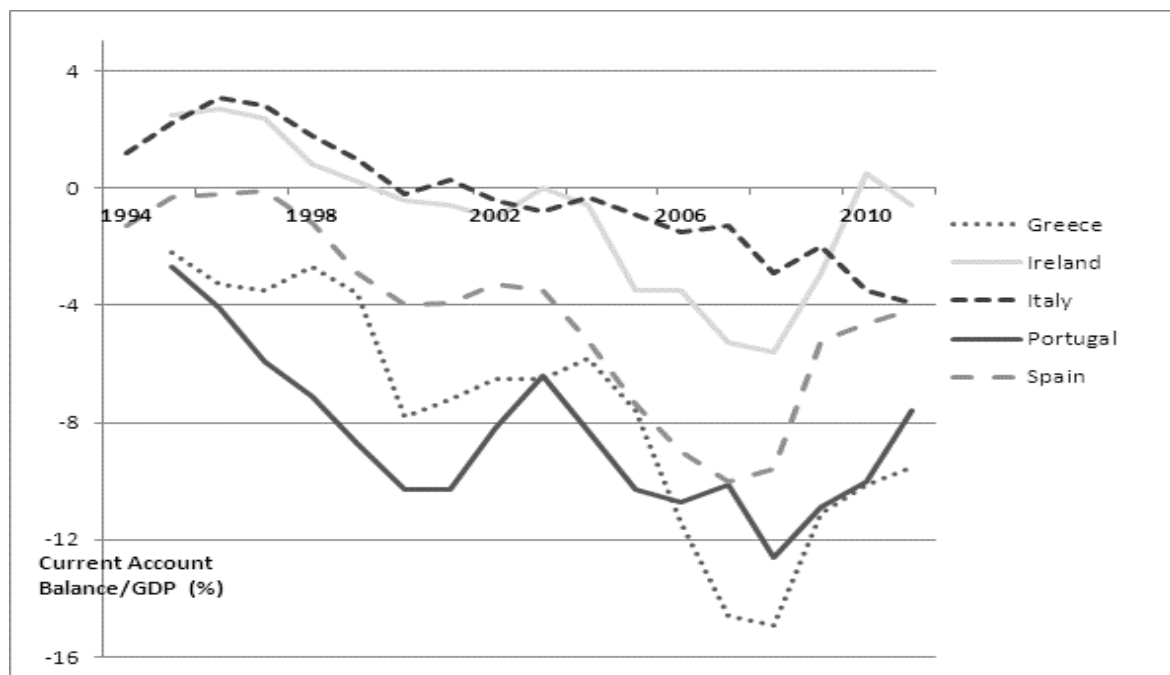


Figure 2b: Annual Current Account Balances for the Peripheral Eurozone members in percentage of GDP.



Source: Eurostat.

As discussed in the Current Account Determination section, the introduction of the euro in 1999 led to a sharp fall in real interest rates, especially in the peripheral countries, as nominal interest rates converged to low German levels. Figures 3a and 3b show the average annual ex-post real interest rates from 1997-2011. Since the collapse of Lehman Brothers, investors have focused on credit risk. As a result, sovereign borrowing costs within the eurozone have become highly polarized. Germany's borrowing costs are at record lows, while other member-states are paying punitively high real interest rates. Greece, Ireland, and Portugal are currently facing 13, 8, and 7 percent ex-post real interest rates. From 1997 to 2001, the countries that experienced sovereign debt crises in 2010 or 2011 enjoyed the largest drops in their ex-post real interest rates. Ireland's real interest rate dropped nearly 5 percent and Portugal's dropped almost 4 percent. Greece's government bond yields fell 9.5 percent and its real interest rate fell 3 percent. In contrast, Germany's real interest rate fell by less than 1 percent over the same period. Ireland, Greece, and Portugal's recent record high interest rates account for their sovereign debt crises, but they also compound the weaknesses of their public finances, and force them to impose ever greater degrees of growth-inhibiting austerity. One result of these austerity programs, since the countries cannot control their money supply, is painful deflation. Figures 4a and 4b show the annual average inflation rates of core and periphery members. While all countries experienced low inflation rates in 2009, only Spain, Portugal, and Ireland experienced deflation. These figures also show that eurozone members have experienced convergence in their inflation rates; however, there was still a 1 percent gap between the core and periphery average in 2005. This inflation gap contributed to the low ex-post real interest rate enjoyed by periphery countries prior to the crisis. This persistent gap also points to the importance of relative prices and the competitiveness hypothesis in explaining current account balances, which will be discussed later.

Figure 3a: Annual Ex-Post Real Interest Rates for the Core Eurozone members.

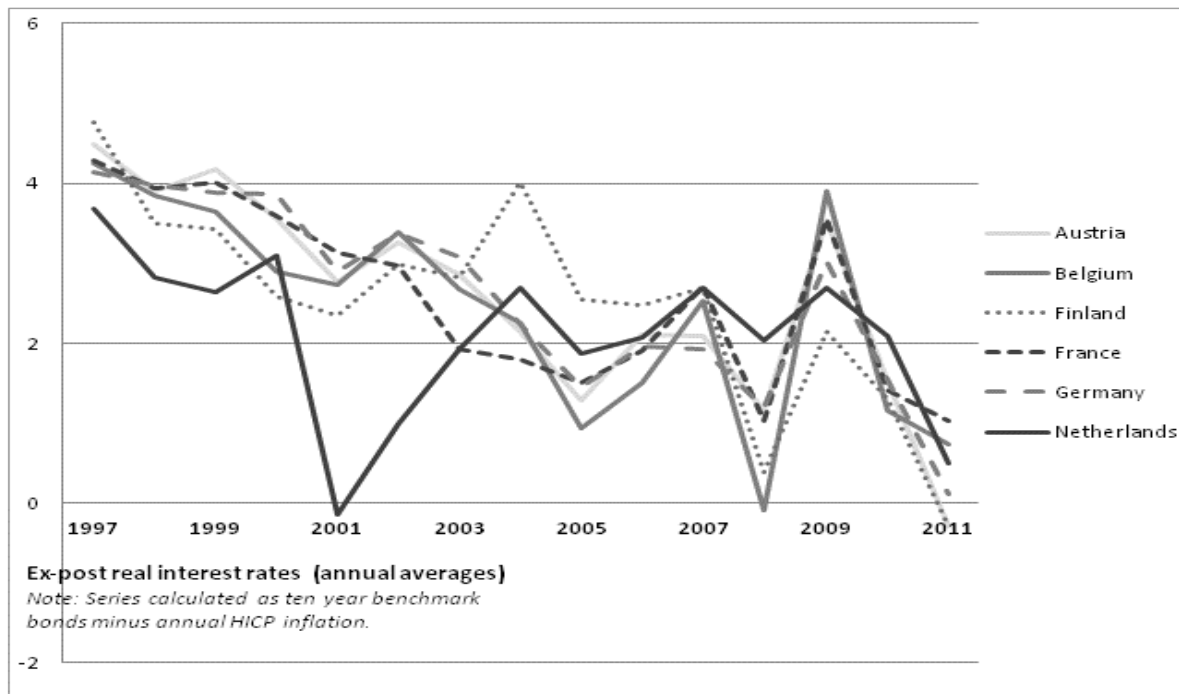
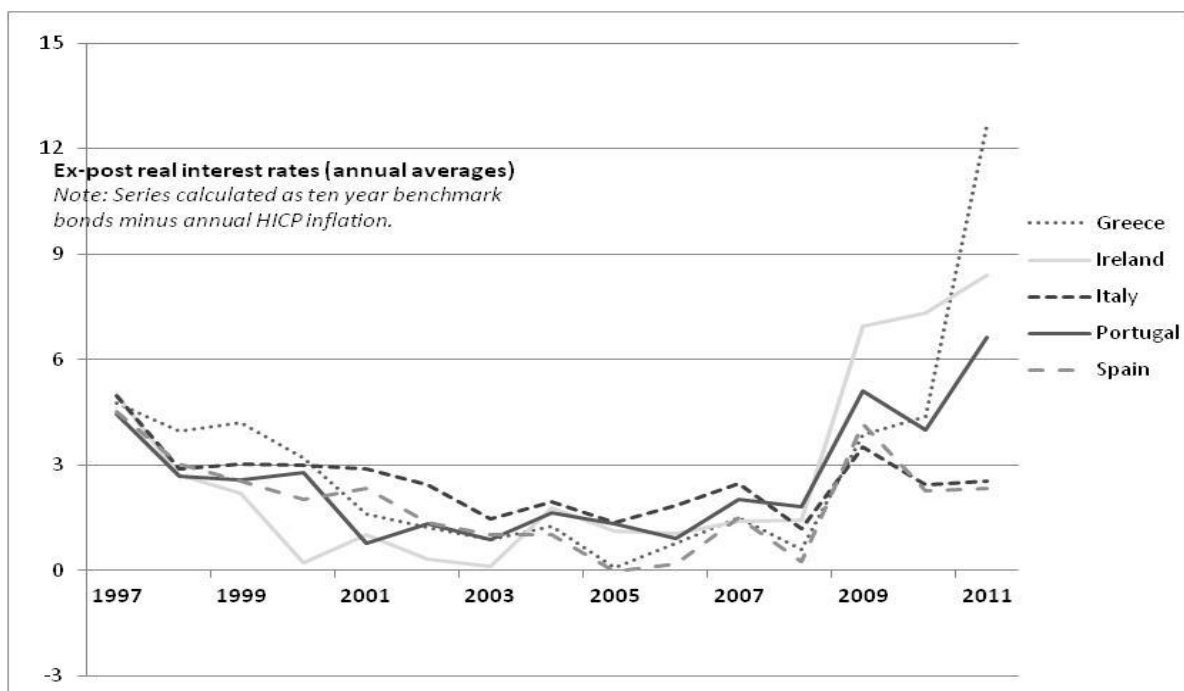


Figure 3b: Annual Ex-Post Real Interest Rates for the Peripheral Eurozone members.



Source: Eurostat.

Figure 4a: Select Annual Inflation Rates in Core Eurozone Members.

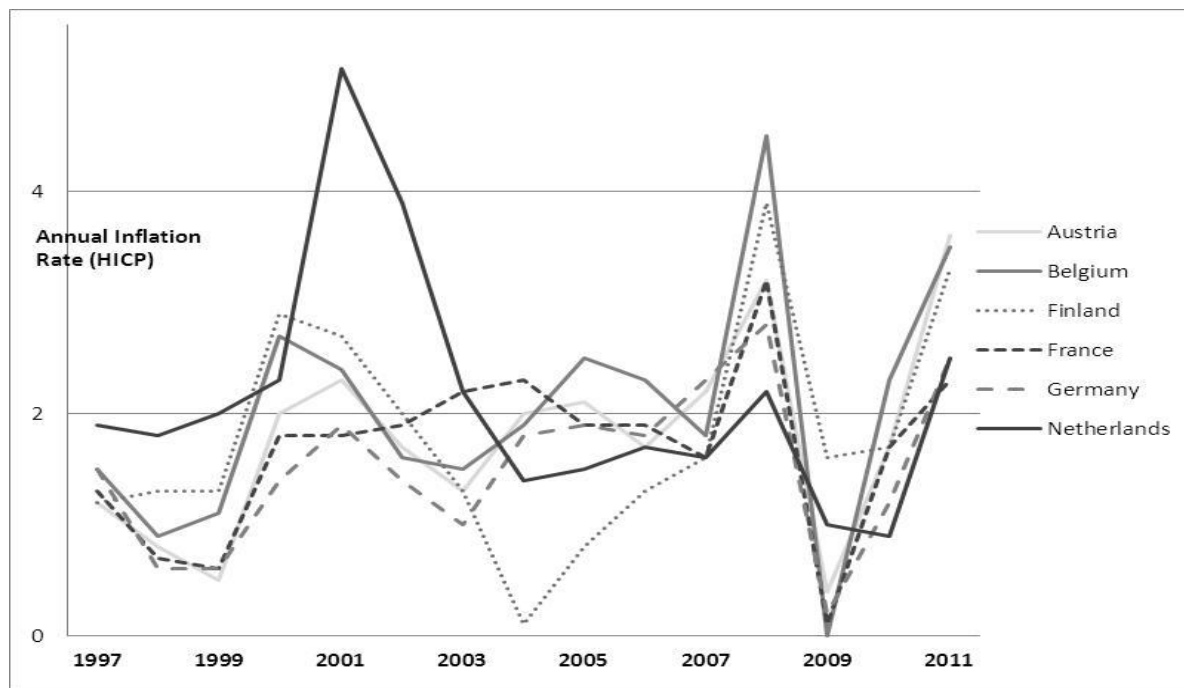
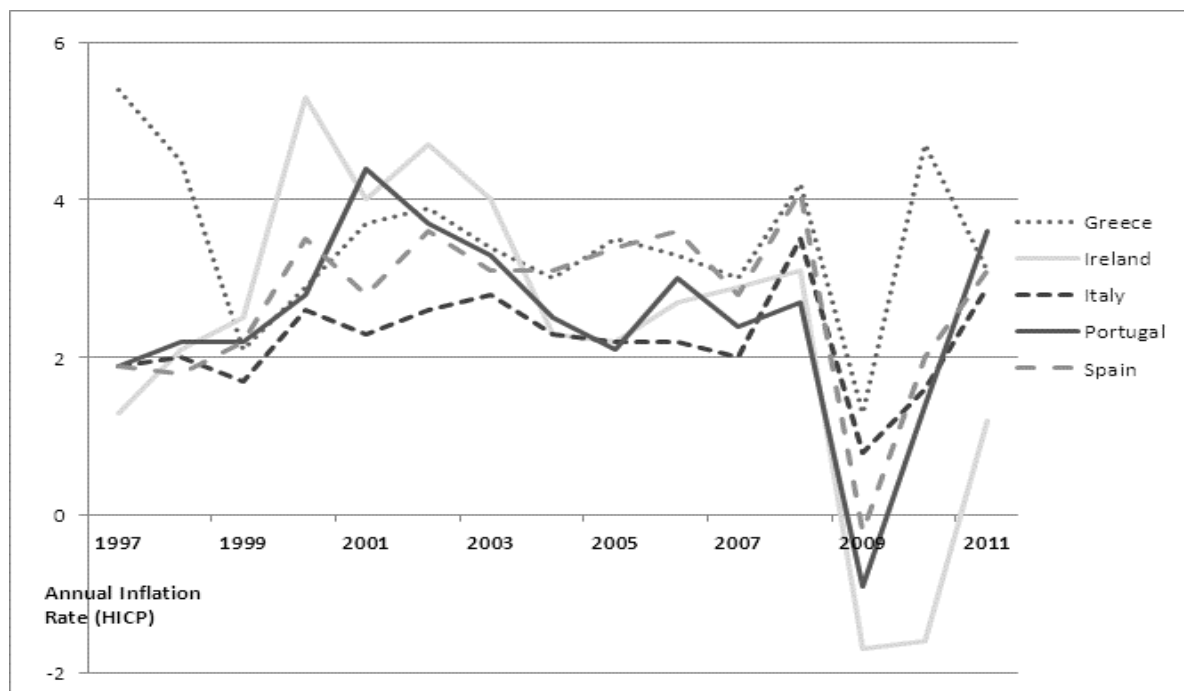


Figure 4b: Select Annual Inflation Rates in Peripheral Eurozone Members.



Source: Eurostat.

After adopting the euro, the consensus outlook for peripheral countries' future income growth was extremely flattering. Neoclassical growth theory, as discussed in the Current Account Determination section, predicted long-run convergence of per-capita income between core and peripheral countries. As shown in Figures 1-3, peripheral countries experienced strong real GDP growth, persistent current account deficits, and lower real interest rates after 1999, as projected by theory. Figures 5a and 5b show the per-capita income in current euros for peripheral and core countries from 1996 to 2011. Periphery countries grew significantly; all countries except Italy at least doubled their nominal per-capita income from 1996 to 2007. Ireland, in particular, displayed impressive growth. In 1996, its per-capita GDP was 16,000 euros and by 2007 it was 44,000 euros. In contrast, no core countries doubled their per-capita income over the same period. While the periphery's impressive growth is partially because their per-capita income is initially much lower, Figures 1a and 1b show that their growth was equally impressive on an aggregate percent change basis. However, as was discussed earlier, peripheral countries were hardest hit by the crisis. Ireland's per-capita GDP fell by 5,000 euros in 2 years. Additionally, the countries that most increased their consumption expenditure prior to 2007 were the most afflicted by the financial crisis. Figures 6a and 6b show the indexed total consumption expenditure of core and peripheral countries from 1996-2011. Of the peripheral countries, Ireland, Greece, and Spain almost doubled their consumption expenditure from 1997 to 2007. Thus, peripheral countries did experience greater growth and consumption expenditure from 1999-2007, which could be a results of income convergence and consumption smoothing. However, even these simple figures seem to suggest that growth expectations were excessively optimistic and if beyond-optimal levels of future consumption were shifted to the present prior to 2007.

Figure 5a: Annual GDP Per-Capita for the Core Eurozone members.

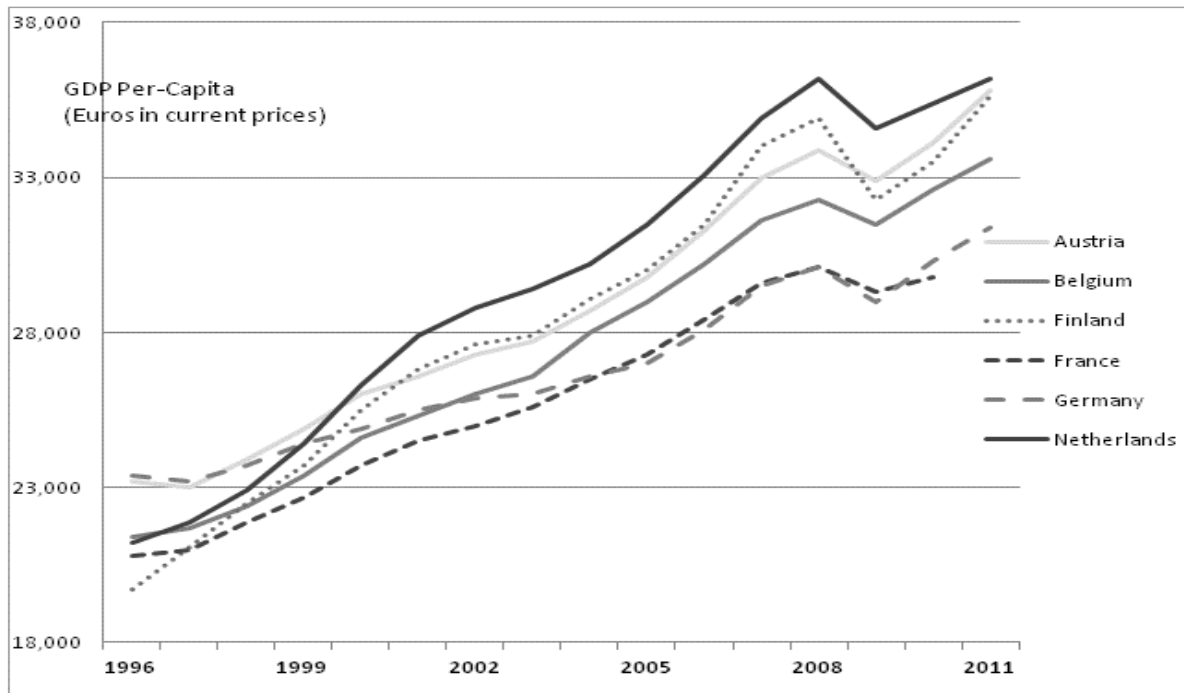
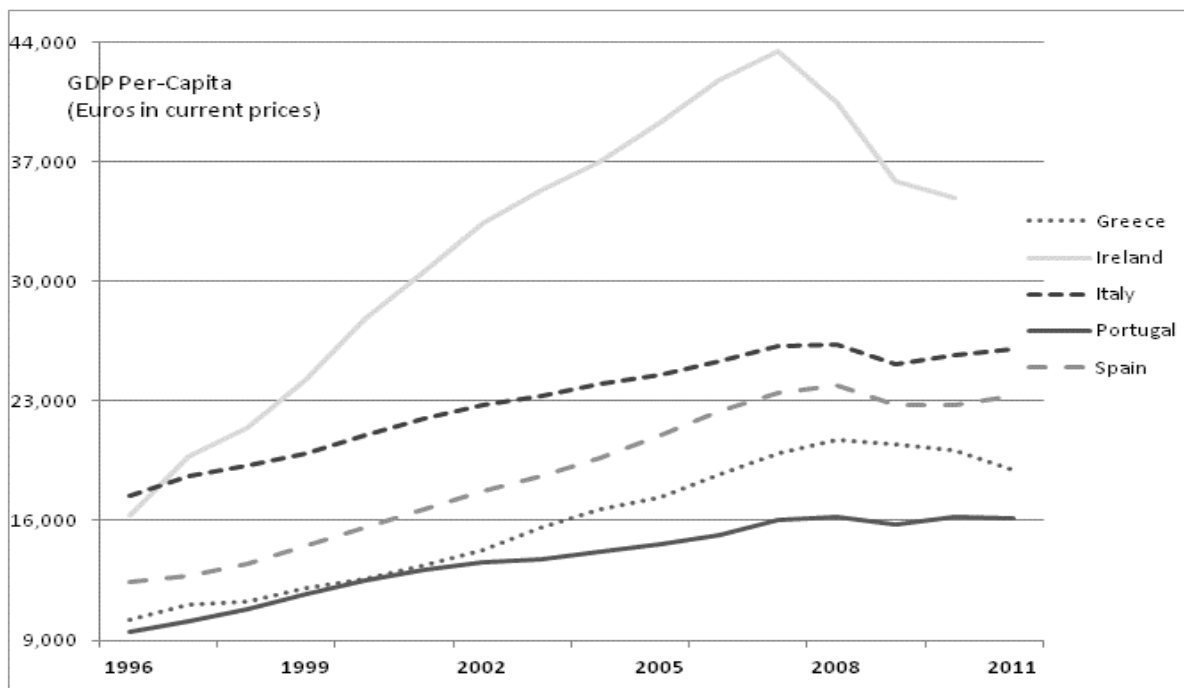


Figure 5b: Annual GDP Per-Capita for the Peripheral Eurozone members.



Source: Eurostat.

Figure 6a: Indexed Total Consumption Expenditure for the Core Eurozone Members.

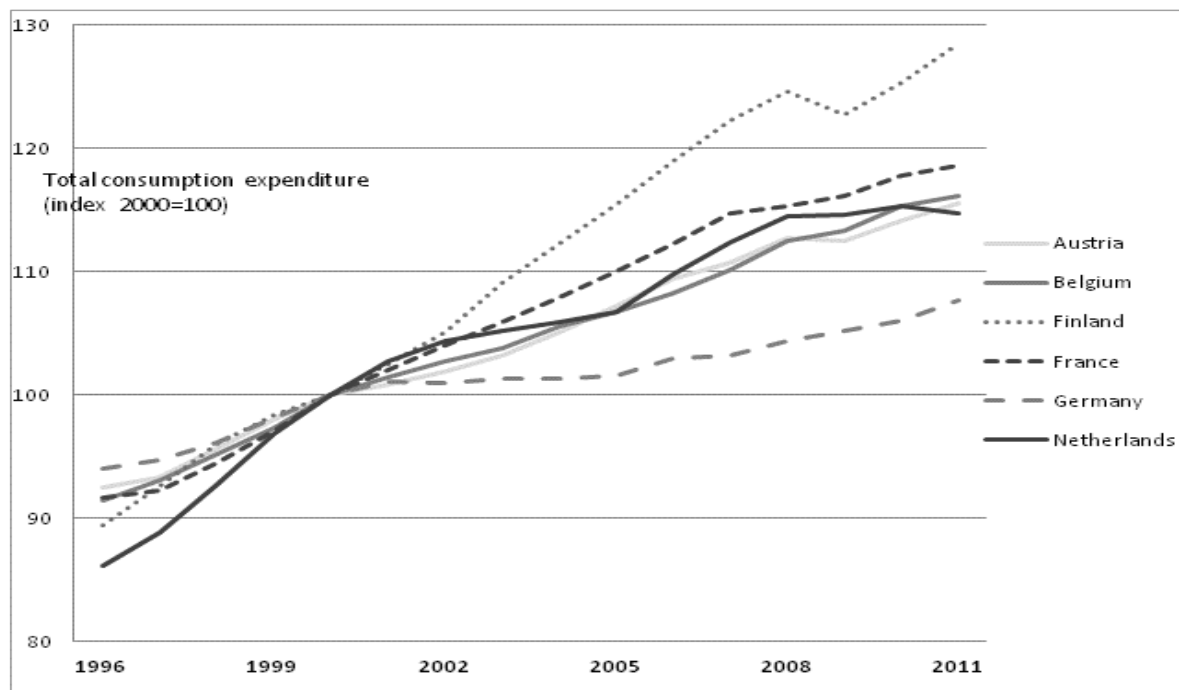
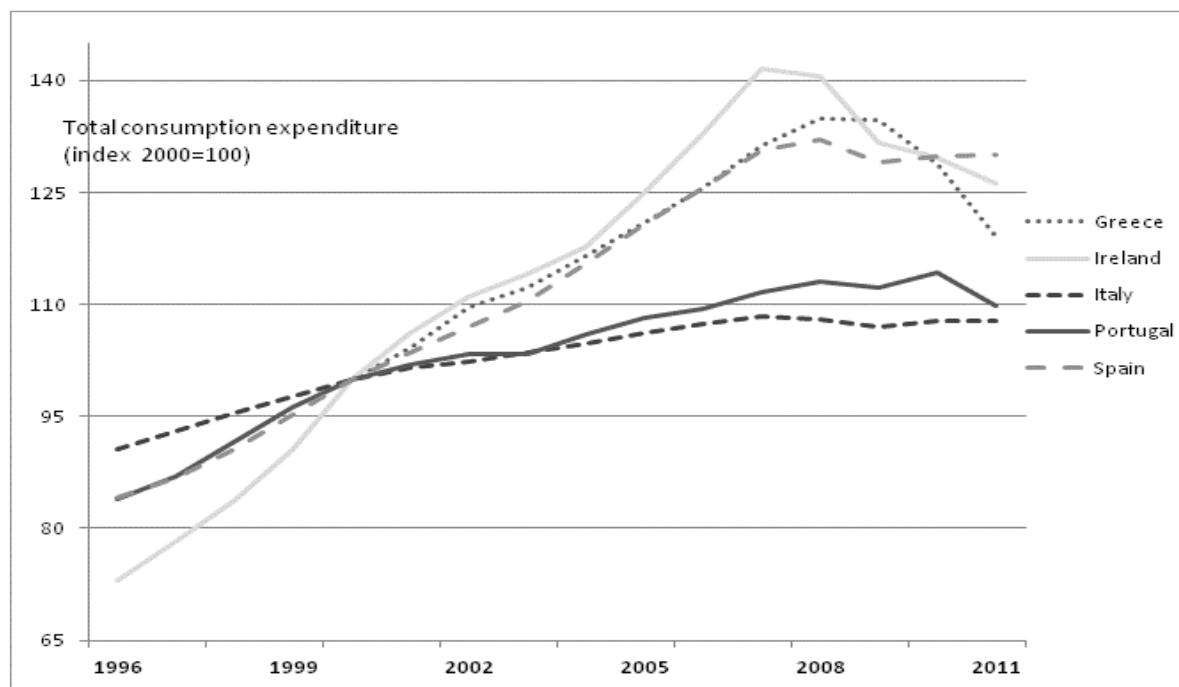


Figure 6b: Indexed Total Consumption Expenditure for the P Peripheral Eurozone Members.



Source: Eurostat.

As a result of lower borrowing costs and widespread optimism, credit growth surged dramatically after the euro was adopted. While at least some of the rapid expansion of credit was justified on fundamental grounds, with the considerable benefit of hindsight, there can be little doubt that a significant component of credit growth was the result of overly optimistic forecasts (see Bernoth and Erdogan, 2010). This optimism served to create and nourish financial and economic imbalances that have ultimately proved unsustainable, most notably in the housing market. Figures 7a and 7b show the volume of construction production from 1996 to 2011. Figures 8a and 8b show the prices of new residential building over the same period. All four figures are indexed at 2005. Peripheral countries displayed higher production growth and higher price inflation in the construction sector. Most dramatically, the volume of construction production and the prices of new houses in Ireland nearly doubled from 1999 to 2007. While Spanish housing price growth was contained, their volume of construction production almost doubled from 1996 to 2007. Especially considering the size of the Spanish economy, this represents a substantial increase. In contrast, core countries experienced drops or minor increases in construction volume and price inflation. This suggests that growth in the peripheral economies (especially Spain and Ireland) was driven at least partially by a surge in their housing markets; such unbalanced growth is often problematic. Sectors of an economy associated with the boom draw resources away from other activities and reduces bank loan diversification, which increases macroeconomic vulnerability to sector-specific shocks. Since the crisis, both Irish and Spanish construction production has dropped below their 1996 level. Their housing boom pre-crisis likely contributed to their current account deficits. Rapid growth led to increased demand for imports, while strong wage growth put pressure on the price competitiveness of the tradable sector. Inflows of financial capital from abroad were needed to finance the current account deficit.

Figure 7a: Construction Production Volume as an Index for Core Eurozone Members.

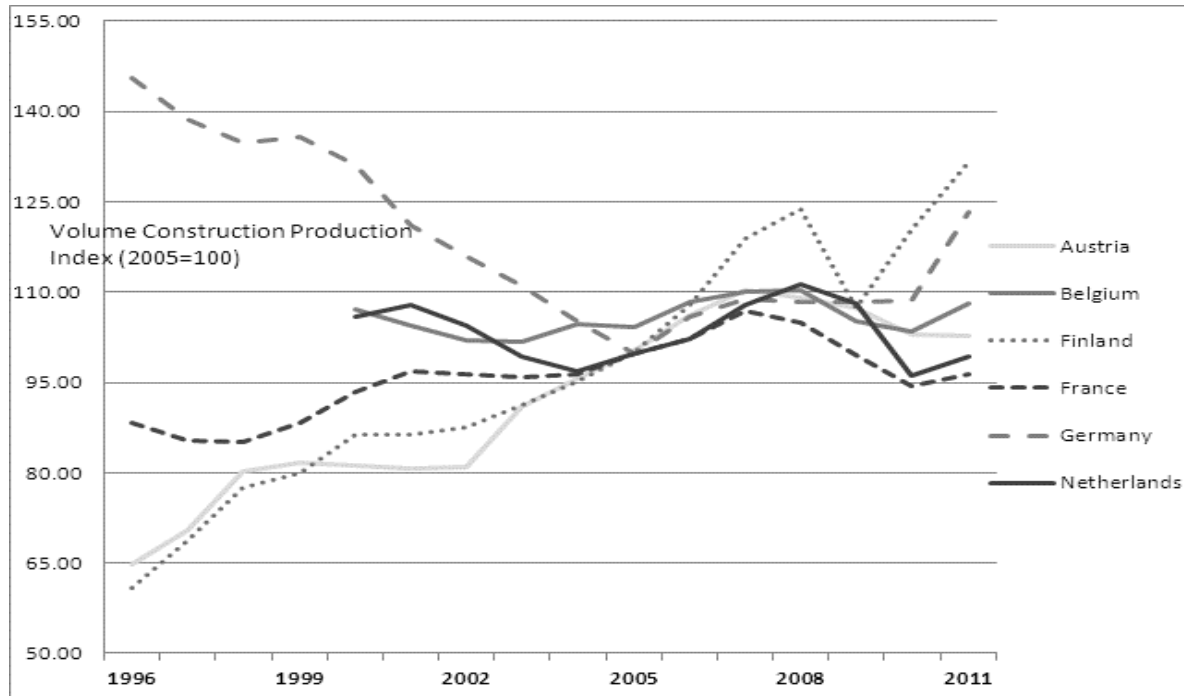
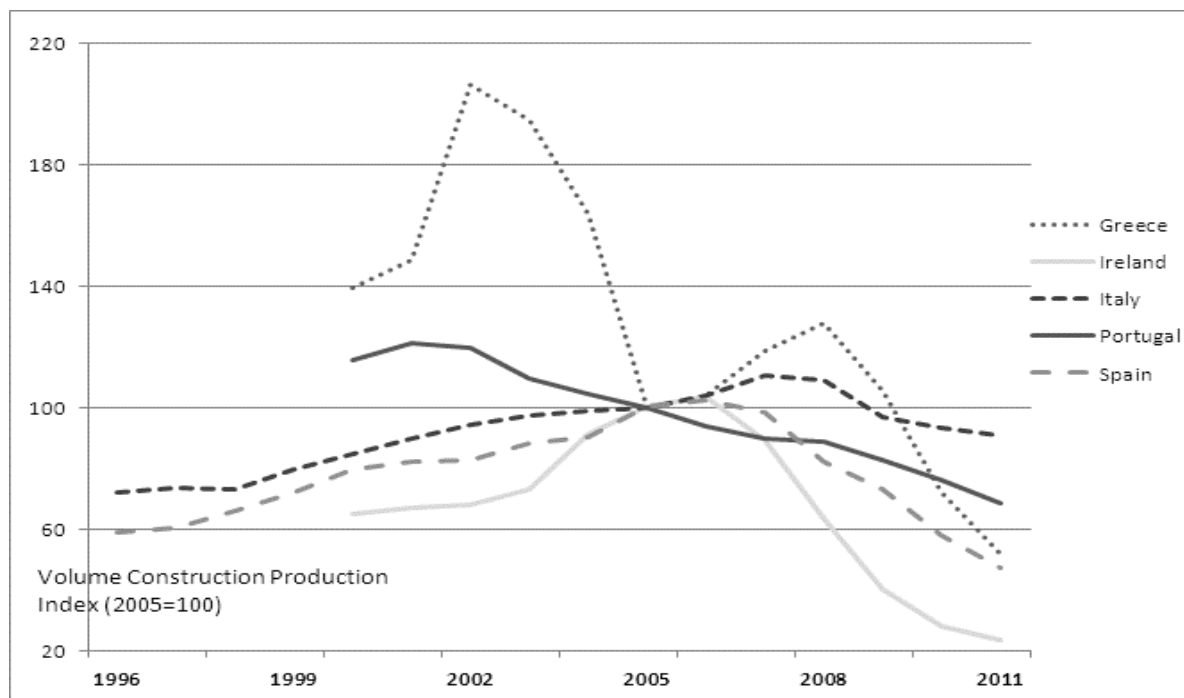


Figure 7b: Construction Production Volume as an Index for Peripheral Eurozone Members.



Source: Eurostat.

Figure 8a: New Residential Building Prices as an Index for Core Eurozone Members.

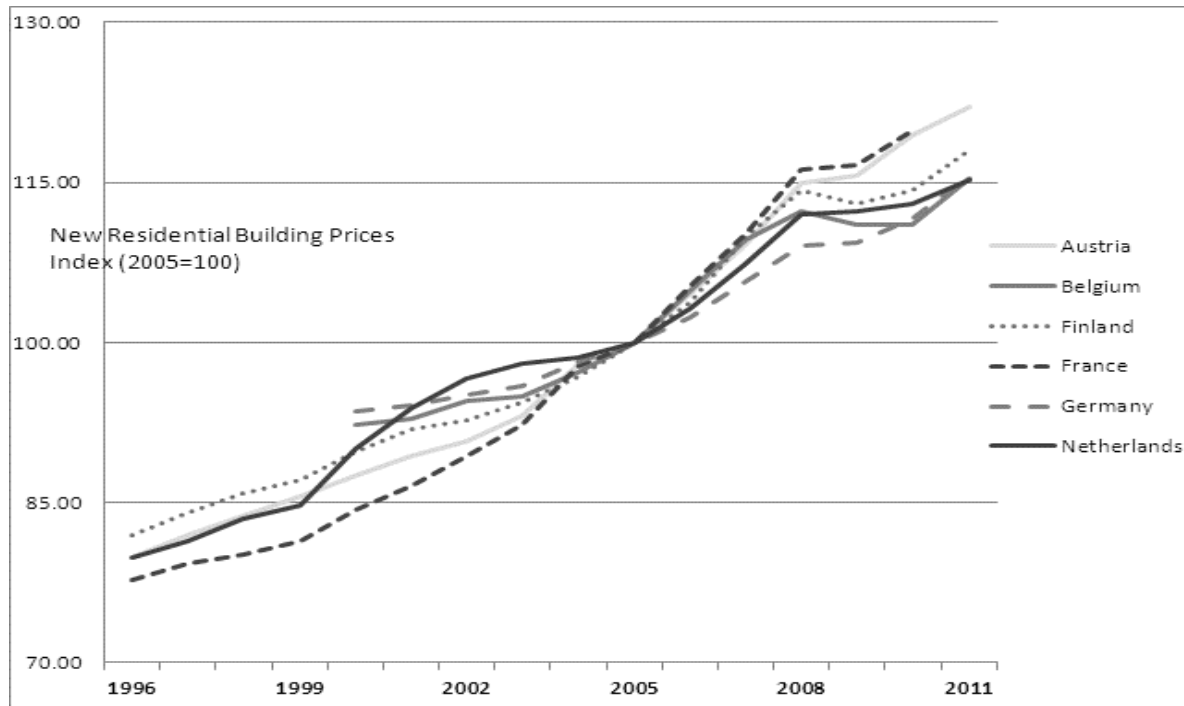
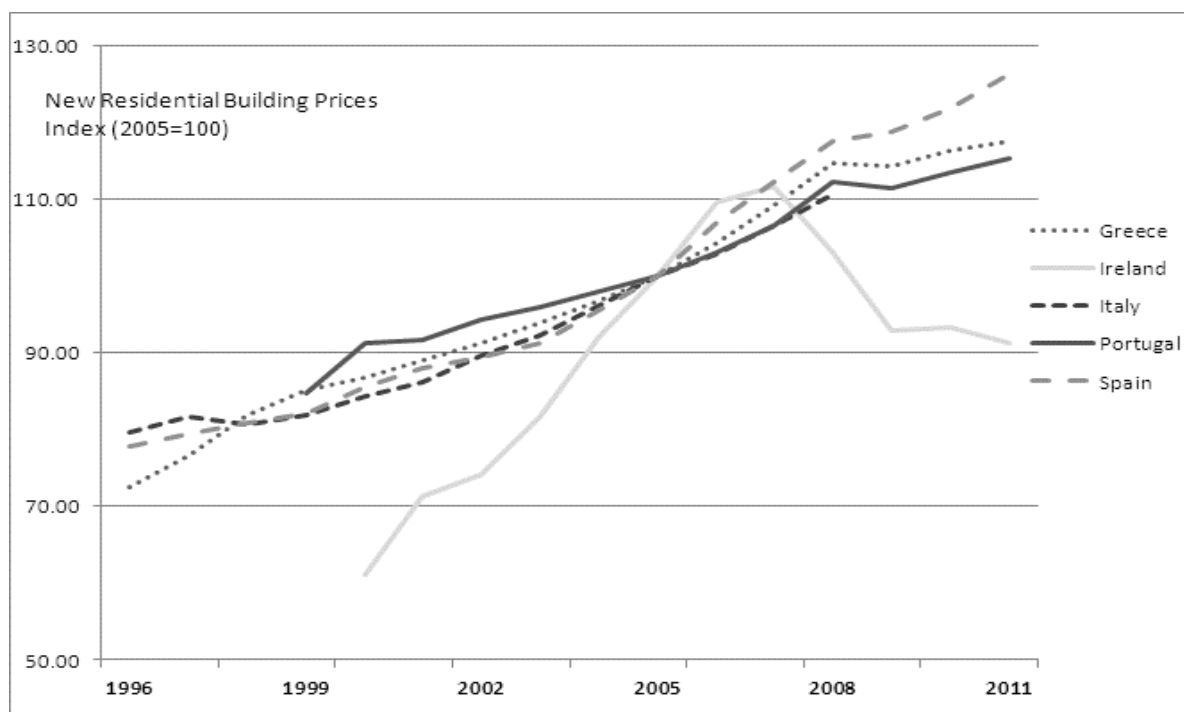


Figure 8b: New Residential Building Prices as an Index for Peripheral Eurozone Members.



Source: Eurostat.

Such unbalanced growth also had important consequences for the fiscal accounts. Before its collapse, the housing boom had a positive impact on broader economic activity and spending, which increased tax revenues. These “windfall” increases to tax revenue were treated as structural rather than cyclical in nature, meaning that governments thought the increased tax revenues were permanent, so they spent it instead of saving it for a “rainy day”. Figures 9a and 9b show the indexed annual total government tax receipts from 1997 to 2010. All the peripheral countries doubled or tripled their tax receipts from 1996 to 2007. Tax revenue in Ireland and Spain, with their undeniable construction booms, experienced a sharp spike in 2007 before the crisis. In contrast, the core countries’ receipts grew at a steady rate and experienced much smaller declines after the crisis. Figures 10a and 10b show the annual average government savings of core and peripheral countries. Since adopting the Euro, eurozone members have had to follow the Stability and Growth Pact (see Filipek and Schreiber, 2010). The Pact requires member government budgets to remain roughly in balance. However, very few countries achieved this. From 2000 to 2007 Finland, Ireland, Austria, Belgium, the Netherlands, Spain, and Portugal followed the 3 percent deficit limit, but only Finland, Ireland, and Spain averaged a balanced budget (or better). Prior to the crisis, Ireland and Spain were regarded as success stories of the eurozone. However, by 2009, Spain and Ireland’s government deficits neared double-digits and in 2010, Ireland’s government deficit was 31 percent of GDP. As demonstrated by Figures 7b, 9b, and 10b, their governments were able to run surpluses prior to the crisis because of substantial construction based windfall revenue. In Ireland, the windfalls supported the implementation of a pro-cyclical fiscal policy, as governments used revenue strength to justify tax reductions and higher public spending. As its banking sector grew rapidly, massive implicit liabilities towards the financial sector were accumulated and after the financial crisis hit, the Irish

government was forced to bailout its largest banks to prevent the collapse of its financial system. Although to lesser extents, Greece and Portugal also benefited from these tax windfalls. In Greece, windfalls allowed the government to obscure fundamental weaknesses in their fiscal system, which was only later revealed when the public accounts statistics were audited. While Portugal experienced smaller tax windfalls, it still averaged a 1.5 percent government deficit. It spent its excess tax receipts on expensive public projects (like building stadiums for the Euro 2004) instead of saving the revenue or using it to address structural challenges (like its aging population). In summary, spending the majority of the construction-based windfall revenues limited the peripheral governments' ability to respond to a crisis. Instead of passing a stimulus plan to boost output, the governments have been forced to pass austerity measures to reduce their government deficits.

According to the twin deficit hypothesis, countries running large government deficits should also be running large current account deficits. From a casual look at the data, this seems questionable (see Figures 2a, 2b, 10a, and 10b). For example, Spain maintained one of the highest government surpluses from 2002-2008, and yet it also had among the highest current account deficits. During the same period, Germany consistently ran modest government deficits and yet had among the highest current account surpluses. There are also some countries that support this hypothesis. For the last 5 years, Greece and Portugal have had among the highest current account deficits and government deficits, while Finland has had current account surpluses and net government savings. However, there are many other important confounding factors, which make looking at these two series alone insufficient.

Figure 9a: Indexed Total Government Tax Revenue for Core Eurozone Members in percentage of GDP.

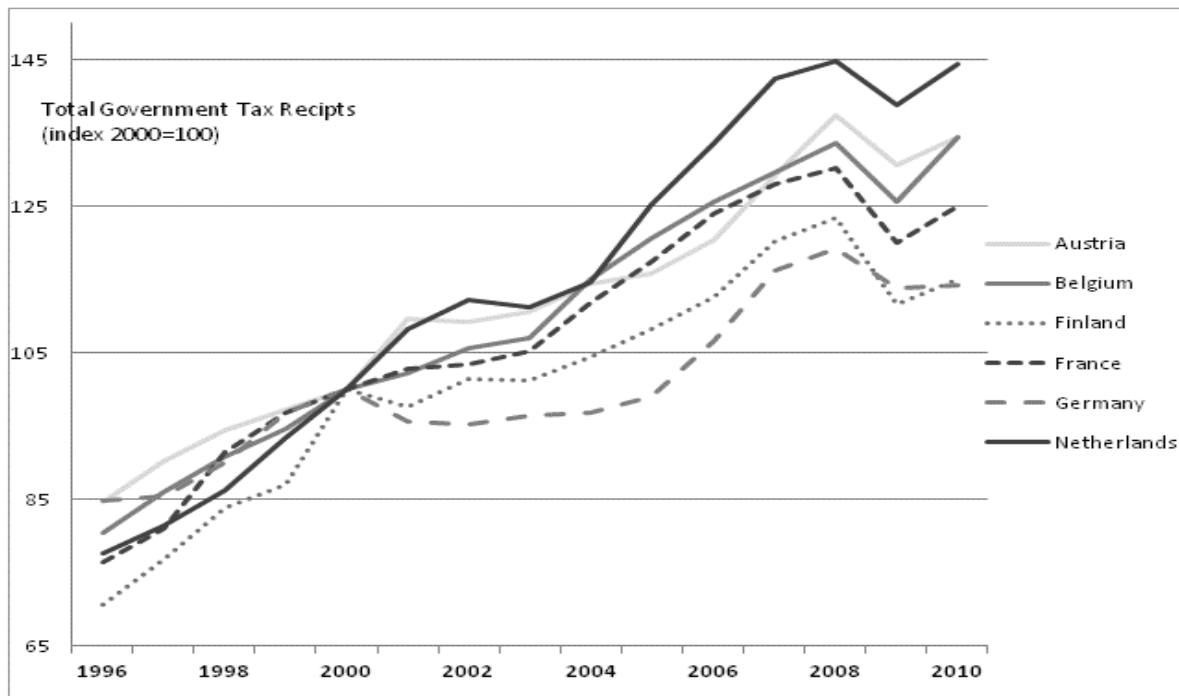
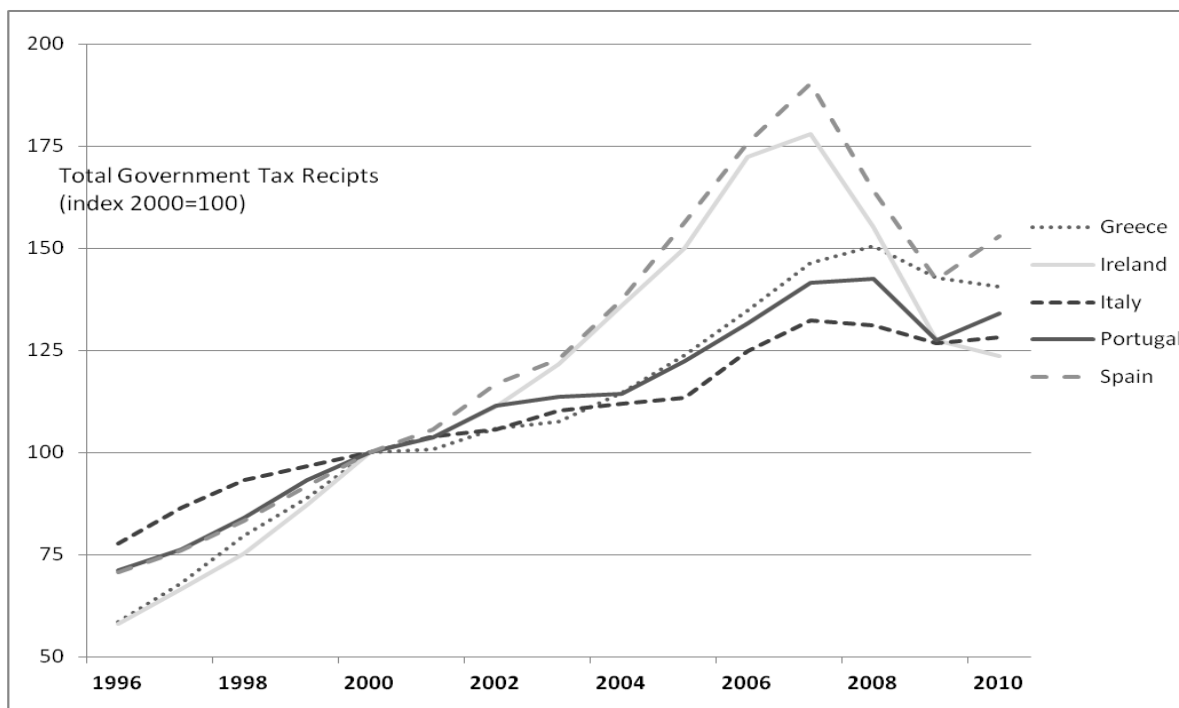


Figure 9b: Indexed Total Government Tax Revenue for Peripheral Eurozone Members in percentage of GDP.



Source: Eurostat.

Figure 10a: Annual Government Savings Balances for Core Eurozone Members in percentage of GDP.

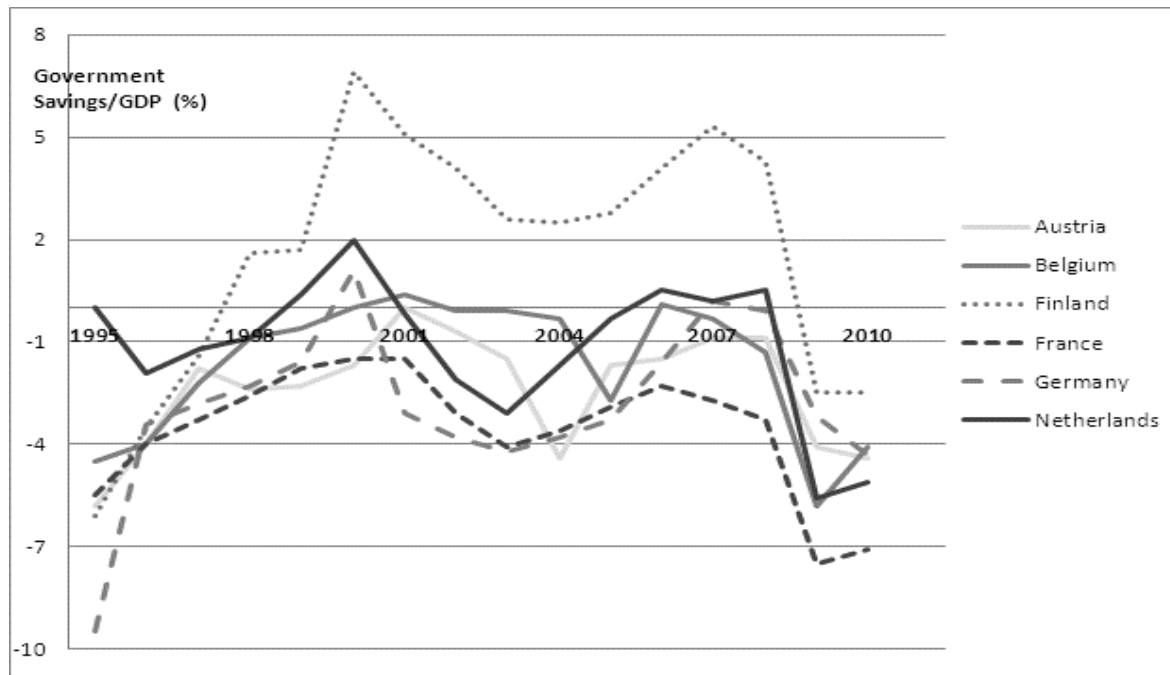
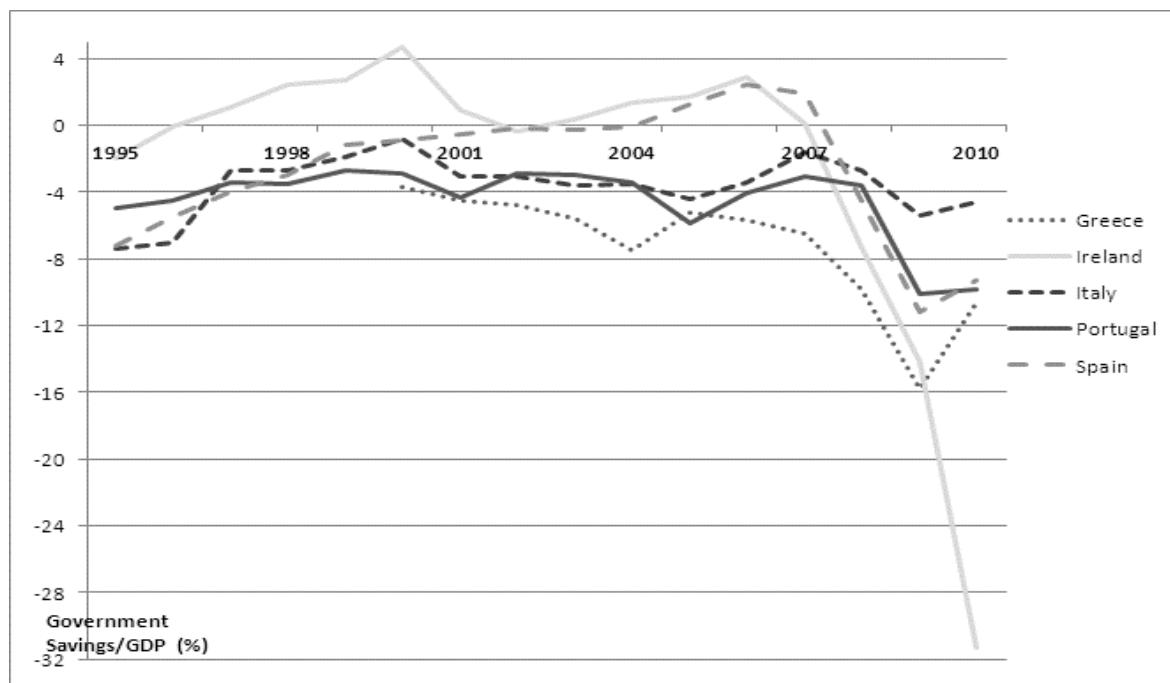


Figure 10b: Annual Government Savings Balances for Peripheral Eurozone Members in percentage of GDP.



Source: Eurostat.

At first glance, the data strongly supports the competitiveness hypothesis. As a result of sizeable and persistent inflation and unit labor cost differentials across countries, certain eurozone members have experienced large swings in their real exchange rates compared to their peers (see Figures 2 and 4). In turn, these changes in relative competitiveness are thought to explain countries' divergent current account balances. Figures 11a and 11b show the manufacturing unit labor costs and Figures 12a and 12b show the real effective exchange rate of core and peripheral countries from 2001 to 2011. Germany averaged less than 2 percent growth of manufacturing unit labor costs from 2001 to 2007. In contrast, peripheral countries averaged 4 percent over the same period. As a result, core countries real exchange rates' have strengthened while peripheral countries' real exchange rates have weakened. Of note, Ireland and Spain averaged almost 5 percent growth in their unit labor costs from 2001 to 2007, which corresponded to a dramatic weakening in their real exchange rate and current account balance. Prior to 2007, all countries that had lost competitiveness relative to other member countries (their real exchange rate has depreciated or risen) were running current account deficits and countries that had gained competitiveness were running surpluses.

As a result of this uneven burden of competitiveness adjustment, as discussed in the Current Account Determination section, some economists and politicians argue that surplus countries are benefiting at the expense of deficit countries within the eurozone, (see Lapavitsas *et al.*, 2010 and Stockhammer, 2011). As stated in the Current Account Determination section, the sum of the public sector balance, the (domestic) private sector balance and the current account deficit have to add up to zero. By implication, in a country that has a current account deficit either the private sector or the public sector has to run a deficit. Stockhammer argues that Germany has pursued a policy of aggressive wage restraint resulting in large current account

surpluses; hence, German gains in competitiveness have not been the result of superior technological performance, but of more effective wage suppression. Consequently, Germany's current account surpluses are some other countries' current account deficits (and capital inflows). Stockenhammer concludes that German wage suppression rather than peripheral fiscal profligacy is at the root of the eurozone crisis. He therefore encourages the eurozone to adopt a comprehensive wage policy that prevents hostile wage restraint by current account surplus countries. While the below figures cannot prove or disprove Stockenhammer's argument, they do suggest that it is possible. Germany has exhibited impressive wage restraint over the last decade, which is in sharp contrast to peripheral countries' fast-rising unit labor costs (see Figures 11a and 11b). Also, because of the ECB's express mission of low inflation, the burden of adjustment does fall almost entirely on the peripheral countries. These issues will be further explored later in the paper; however, it is impossible to determine whether Germany's intentions were "hostile" or "predatory".

Table 1 calculates the simple correlations for these variables for each country and groups of countries. These simple calculations prove nothing, but they do hint at the complexity of the eurozone. While the eurozone as a whole exhibits some support for the twin deficit hypothesis, a correlation of .234, the core countries exhibit very positive correlations, while the peripheral countries exhibit very negative correlations. In other words, the peripheral countries show signs of twin divergence—the government savings and current account balance tend to move in opposite directions. The other relationships cannot be defined on such simple peripheral and core lines.

Figure 11a: Manufacturing Unit Labor Costs for Core Eurozone Members in Annual Percent Change.

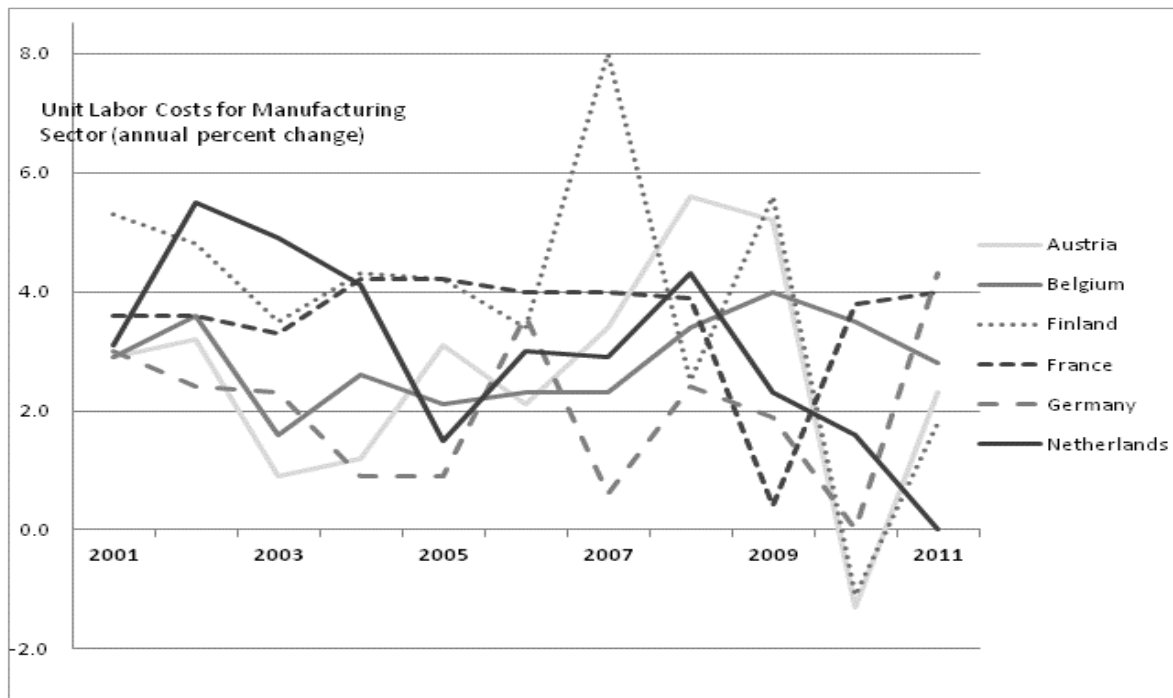
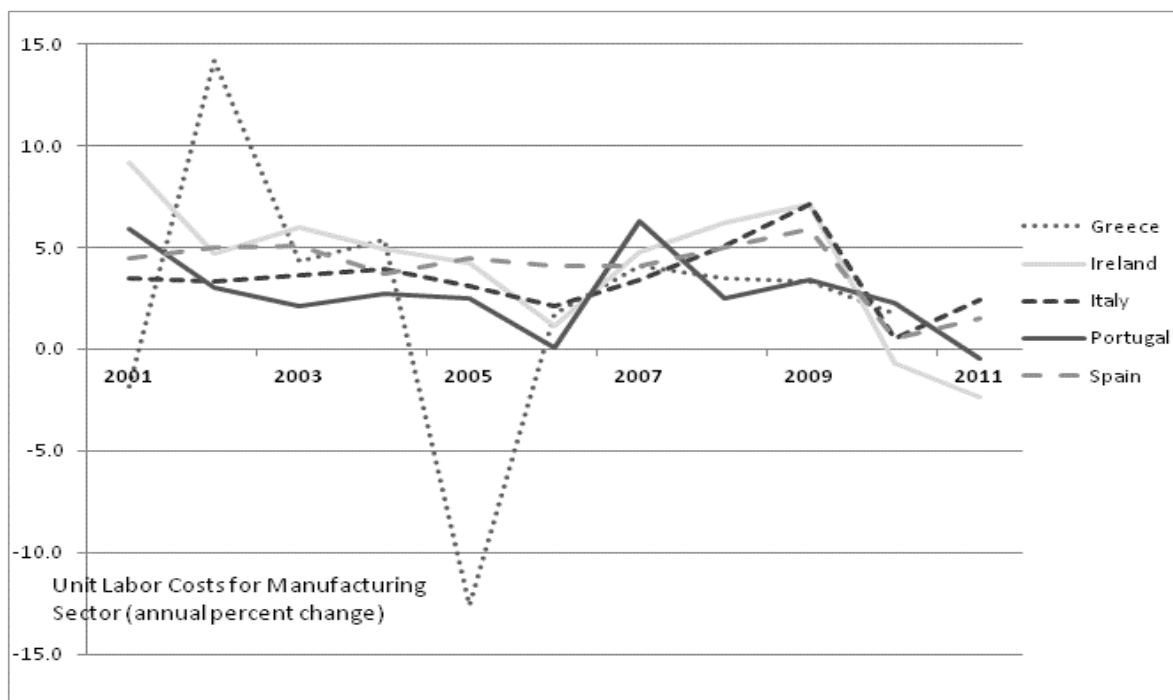


Figure 11b: Manufacturing Unit Labor Costs for Peripheral Eurozone Members in Annual Percent Change.



Source: Eurostat.

Figure 12a: Annual Effective Real Exchange Rates (index 1999=100) for Core Eurozone Members.

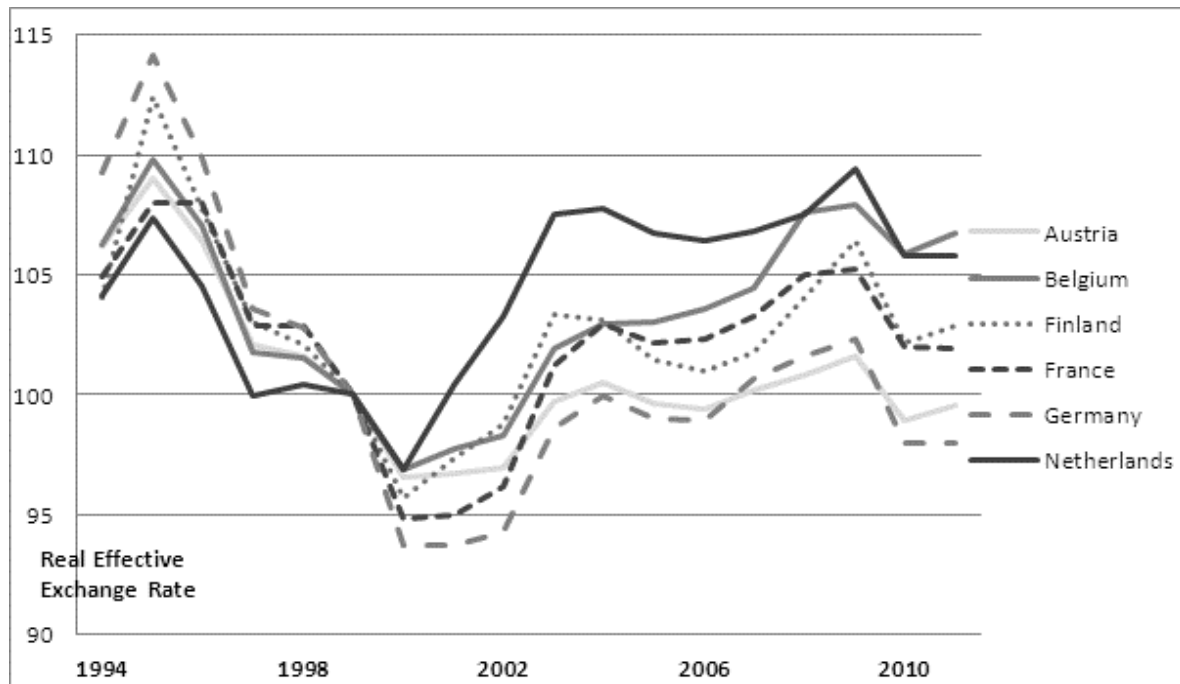
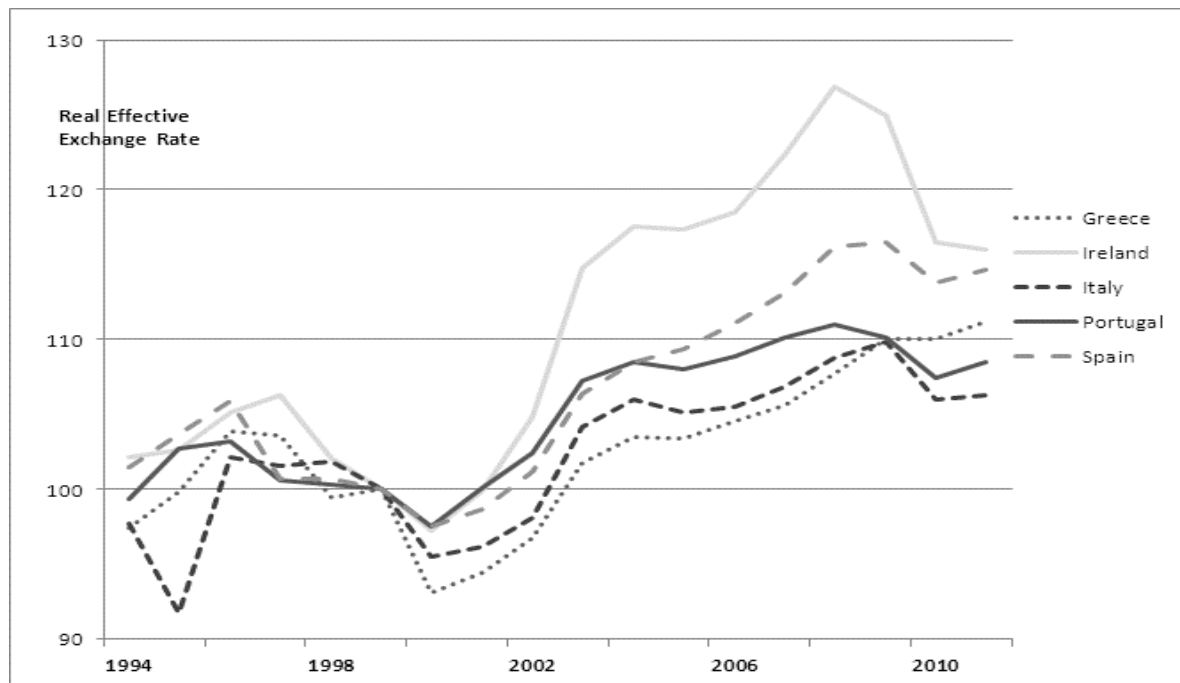


Figure 12b: Annual Effective Real Exchange Rates (index 1999=100) for Peripheral Eurozone Members.



Source: Eurostat.

Table 1: Data Correlations by Country.

Correlations by country and panel, 1996q1-2010q4					
Country	Current account/GDP and government savings/GDP	Current account/GDP and real exchange rate	Current account/GDP and investment/GDP	Current account/GDP and real GDP growth	Real GDP growth and government savings/GDP
Austria	0.339	(-0.809)	(-0.857)	(-0.090)	(-0.059)
Belgium	0.056	(-0.353)	(-0.710)	0.342	0.085
Finland	0.347	0.363	(-0.182)	0.295	0.060
France	0.247	(-0.745)	(-0.870)	0.448	0.193
Germany	0.193	0.261	(-0.851)	0.001	(-0.101)
Netherlands	(-0.316)	0.745	(-0.789)	(-0.221)	0.331
Greece	(-0.378)	0.523	(-0.563)	(-0.321)	0.402
Ireland	(-0.400)	(-0.359)	(-0.631)	0.018	0.301
Italy	0.179	(-0.536)	(-0.547)	0.202	0.028
Portugal	(-0.495)	0.277	(-0.601)	(-0.048)	0.187
Spain	(-0.587)	(-0.579)	(-0.937)	0.103	0.292
Eurozone	0.234	(-0.011)	(-0.350)	0.099	0.207

IV. Literature Findings

There is a growing empirical literature which focuses on current account determinants, sustainability, and adjustment process; however, the empirical research suggests that the findings are heavily influenced by the choice of the research period, the econometric methods and, in particular, the country sample. For a comprehensive literature review, see Taylor 2002. I will focus particularly on the studies that examine the eurozone.

Both conventional economic theory and empirical studies argue that adopting the Euro promoted financial integration in the eurozone. Recent empirical studies have found evidence suggesting that financial market integration has increased due to the introduction of the common currency. Schmitz and von Hagen (2011) used panel estimations to find evidence that the introduction of the euro has deepened financial market integration in Europe. They found that capital flows from high per-capita GDP to low per-capita GDP countries only within the eurozone which can be expected to promote economic convergence among the member countries. As a result, they argue that the international allocation of capital is becoming more efficient in the eurozone and that the observed current account imbalances indicate that the monetary union works well. Correspondingly, Arellano and Heathcote (2010) show that permanent restrictions on domestic monetary policy can increase sovereign borrower's credibility in international financial markets which consequently increase their international financial integration because asset prices increasingly conform to the law of one price. They argue that correlations in bond returns are very high within the eurozone and prior to the crisis spreads across government bond yields had narrowed. Decressin and Stavrev (2009) compared the current account dynamics in EMU countries with 12 other advanced economies using a panel VARs and impulse response

functions. They found that the size of current account shocks has fallen but their persistence has risen in the EMU, while the current account dynamics in other advanced economies have remained broadly unchanged. As a result, both the size of shock and the speed of adjustment are now significantly lower in EMU countries.

Most authors have found support for the catch-up process in the European Union between developing and industrial countries. Herrmann and Jochem, (2005) used a Feasible Generalized Least Squares panel model and found that the current account deficits are essentially determined by domestic investment activity, while Blanchard found the main driver of current account deficits to be lower private saving-due to both internal and external financial market liberalization but also to better future growth prospects-and, to a lesser extent, higher investment. Chinn and Wei (2009), found support for the catch-up effect having a natural, non-destabilizing effect on current account balances. They used a variety of autoregressions for a panel of 170 countries to estimate the rate at which current account balances revert to their mean values. They found no significant differences in the adjustment process with regard to the flexibility of the exchange rate regime, thereby contrasting the predominant view that greater flexibility would be conducive to these adjustments. In contrast, Herrmann and Winkler's (2009) results supported the predictions of the Mundell-Fleming model discussed earlier. They found that flexible exchange rate regimes exhibit less current account persistence than fixed exchange rate regimes. They adopted different model specifications and only looked at a panel of eleven European countries.

Even though authors have found support for the catch-up process in the eurozone, it does not imply that the extent of borrowing that actually took place has been optimal. As argued by Jaumotte and Sodsriwibon (2010), the increase of the construction sector in some countries

provides evidence that domestic residents may have borrowed from abroad for consumption beyond an optimal level. Blanchard (2006) ascribed the economic boom in Portugal in the late 1990s to the sharp drop in interest rates and excessively rosy expectations for convergence due to the eurozone membership. This led to wage increases exceeding productivity growth. Competitiveness deteriorated, export growth weakened, and external deficits widened. Thus, as argued by Giavazzi and Spaventa (2010) and Jaumotte and Sodsriwibon (2010), if consumers overestimate their future income, they over consume in the short run, which contributes to competitiveness problems.

Many mainstream international macroeconomic models model the changes in current account on real exchange rate shifts; however limited evidence establishes its empirical validity exists. For the EMU member states, Arghyrou and Chortareas (2008) found a positive relationship between the movements of the real effective exchange rates and the current account for most countries over the past four decades. As a result, they argue that a cost of EMU participation and meeting the nominal convergence criteria is growing current account imbalances and the polarization of current account balances within the EMU.

The relationship between government savings and the current account balance is probably the most researched, but the results have varied greatly. Beetsma and Giuliodori, (2008) used panel VARs to determine the effect of a fiscal shock on EMU members' current account balances. They concluded that a one-percent of GDP increase in government spending produces a 1.2 percent impact on the current account. For a large set of OECD countries over the period 1960-1995, Lane and Perotti (1998, 2003) link the trade balance and its components to the different components of the public budget. They found that the composition of a change in fiscal policy and the exchange rate regime matter in terms of the strength of the effect on the external

account. In both studies they concluded that higher government spending produces a deterioration of the trade balance, especially under flexible exchange rates. However, Cuaresma and Reitschuler (2007), also examined EMU members and found that consumers have become Ricardian as a result of the introduction of the fiscal rules implied by the Maastricht criteria and the Stability and Growth Pact. However, most authors' results are more moderate. Aristovnik and Kejzar (2001) and Aristovnik (2002) estimate the determinants of current account deficits for twelve transition economies and test for the twin-deficit hypothesis. They find that Ricardian equivalence is not strictly valid but cannot be rejected either.

Lane and Milesi-Ferretti (2002, 2003), determined that changes in foreign asset valuation stemming from exchange rate adjustments will tend to affect the adjustment process of current account balances. Benetrix and Lane (2009) examine how shocks to different components of government purchases affect the real effective exchange rate of EMU countries. A positive shock to wage government consumption produces an appreciation, but not for an increase in non-wage government consumption. Beetsma and Giuliodori (2010) employed panel VARs to determine the consequences of a discretionary increase in government purchases in the EU. They found support for the twin-deficit hypotheses; in result to the shock, that the real exchange rate appreciates, the public budget deteriorates and the trade balance deteriorates. In contrast, Kim and Roubini (2008) found evidence of twin-divergence. They used VAR models for the US to simulate "exogenous" fiscal policy shocks controlling for the business cycle effects on fiscal balances. They found that increases in private savings and falls in investment contribute to the current account improvement while the nominal exchange rate depreciation, as opposed to the relative price level changes, is mainly responsible for the real exchange rate depreciation.

More recently, Decressin and Stavrev, (2009) compared the current account dynamics in EMU countries with 12 other advanced economies using a panel VARs and impulse response functions. They found that the size of current account shocks has fallen but their persistence has risen in the EMU, while the current account dynamics in other advanced economies have remained broadly unchanged. As a result, both the size of shock and the speed of adjustment are now significantly lower in EMU countries.

Zorzi, Chudik, and Dieppe (2011) investigated millions of different models of current account determination and select the best based on statistical and economic criterion. All the models find the probability that current account balances were aligned with macroeconomic fundamentals prior to the financial crisis minimal. Thus, they argue that current account imbalances are an important root cause of the global financial turmoil

In conclusion, there is no agreement in the literature about the determinants of the current account balances in the eurozone or even whether or not they are problematic. Several papers have tried to identify the medium-term determinants of the current account drawing from an extended class of intertemporal models with overlapping generation models, however, as pointed out by Calderon (2002) and Chinn and Prasad (2003), no single theoretical model captures the entire range of empirical relationships affecting the current account balance. I will overcome this limitation by using two models: a system-GMM dynamic panel estimator and country-specific time-series VARs. This will uniquely allow me to observe short-run trends for the entire eurozone and long-run country-specific trends in the determination of current account balances in the eurozone.

V. Data and Estimation Issues

As demonstrated by the eclectic selection of models used in the literature, there are a number of competing considerations that guide model selection. Model selection greatly depends on whether the dataset is a panel or time-series. To utilize the strengths of both panel and time-series data, I will estimate two models. For the first I will use the System-Generalized Method of Moments (System-GMM) panel model and for the second, I will use a vector auto-regression (VAR) time-series model for each country. All of the alternative estimators have particular shortcomings. The pooled OLS estimator does not control for the joint endogeneity of the explanatory variables or for the presence of country-specific effects. The within OLS estimator accounts for the country-specific effects but does not account for the joint endogeneity of the explanatory variables. Both VAR and system-GMM models' address these endogeneity issues; however, VAR models explain the long run structural relationship between the current account and the explanatory variables, while system-GMM models identify short-run dynamics. Both of these models will be discussed in greater detail in the following sections.

The above discussions suggest a number of factors that might be important factors in determining the current account for either a panel or time-series approach. I will use quarterly data from 1996 to 2011 for the 11 members of the eurozone: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. I begin with 1996 because these countries had already committed to adopting the euro and consequently started reducing their government deficits and debt as a convergence requirement to the Maastricht Treaty and because data availability prior to 1996 is poor. The variables should be normalized in terms of

GDP so that the variables can be compared across countries. All of the variables are from Eurostat.

Current account as a percentage of GDP (CA): this will be the dependent variable.

Government savings as a percentage of GDP (GOV): this variable is the budget surplus or deficit of the central government and will be used to test the twin deficit hypothesis. If the twin deficit hypothesis is true, this coefficient should be positive *ceteris paribus* because an increase in the government deficit results in an increase in the current account deficit. If the Ricardian equivalence theorem is true, this coefficient should be zero because an increase in the government deficit has no effect on the current account balance. Most studies have found a small positive relationship (see Taylor, 2002). At first glance there is a positive relationship (see Figure 13).

Log of the real effective exchange rate (REER): this variable is the quarterly average of the exchange rate movements. It is deflated using unit labor costs and logged, as recommended by Lee and Chinn (2006). After 1997, the unit labor cost measure deviates from CPI and PPI measures; they argue that the REER divergence between core and periphery is most telling when labor unit costs are used. This variable will be used to test the competitiveness hypothesis. The effect of the REER should be negative. It generally tends to rise (depreciate) when countries become less competitive as a result of wage gains outpacing productivity gains. At first glance, there is a negative relationship (see Figure 13).

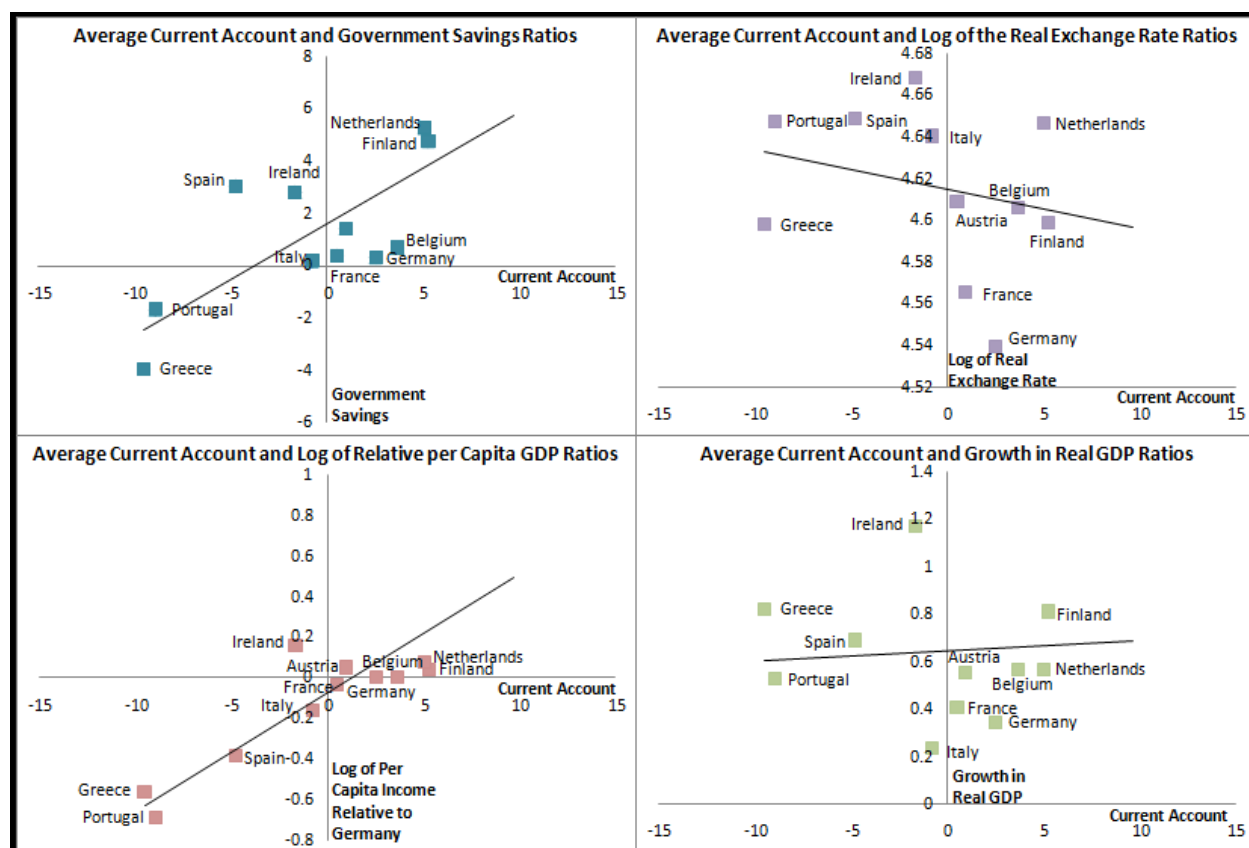
Log of gross fixed capital formation as a percentage of GDP (GFCF): this is also known as planned gross domestic fixed investment. It includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and

commercial and industrial buildings. This will control for the differences in openness to foreign capital by different countries. Additionally, it will control for differences in construction sector growth, since it includes new construction projects. *Ceteris paribus*, this coefficient should be negative unless domestic fixed investment is entirely financed from domestic savings, in which case it should be zero. The absolute value of this should be less than one because it is in logs and the absolute value should approach one for the countries that are most open to international capital flows.

Log of relative per-capita income (PCI): this is the per-capita income of the country relative to Germany. This will be used to test the catch-up hypothesis. Greece and France do not have per-capita income data in quarterly form prior to 2001, so I use annual per-capita income converted into quarterly form for them. Economic theory suggests relative per capita income should be positive because *ceteris paribus*, an increase in per-capita GDP relative to Germany means that the country is catching up. At first glance this is positive (see Figure 13).

Controls (controls): several different types of controls were tried. Private consumption was used to control for business cycle effects in bilateral trade data was used. Unemployment was used to control for labor market rigidity and domestic business cycles. Relative export price inflation was used to control for prices. Demographics were controlled for with an age dependency ratio. A dummy variable was used to control for a possible structural break at the start of EMU. EMU interest rates were used to control for monetary policy decisions.

Figure 13: Current Account and Government Savings, Real Exchange Rate, Per Capita Income, and Growth in Real GDP.



Source: Eurostat.

VI. System-GMM Model

My model for the system-GMM approach is specified as follows:

$$CA_{i,t} = \alpha + B_1 CA_{i,t-1} + B_2 Gov_{i,t} + B_3 PCI_{i,t} + B_4 REER_{i,t} + B_5 GFCF_{i,t} + B_6 Cnrt_{i,t} + u_{i,t} + e_i$$

An important feature of this model is the one-period lagged current account balance, which produces a dynamic model setting. If the lag is not included, then the regression will capture the influence of initial conditions if the country-specific effect is correlated with the regressors. As a result, countries with a large current account deficit at the beginning of the period would be treated as more likely to run large current account deficits over the sample. Also, $u_{i,t}$ is likely to be serially correlated both because of an unobserved time-varying effect and because the period length may not be long enough to ensure exogeneity. The lagged dependent variable accounts for this. However, not only are our explanatory variables almost certainly correlated with the error term, but the lagged dependent variable introduces an additional endogeneity problem. It is a function of $u_{i,t}$ therefore we use an instrument to do away with the correlation between $u_{i,t}$, the lag, and the exogenous explanatory variables.

The system-GMM introduced by Arellano and Bover (1995) and Blundell and Bond (1997) overcomes these limitations by joining a single system equation in both differences and levels, each with its specific set of instrumental variables. As a result, it accounts for possible endogenous variables, fixed effects, heteroskedasticity, and short run dynamics. Although there may be correlation between the levels of the right hand side variables and the country-specific effects, there is no correlation between the differences of these variables and the country-specific effects. The use of instruments is required to deal with two issues. First, the likely endogeneity of the explanatory variables, which is reflected in the correlation between these variables and the

error term; second, the new error term, $(e_{i,t} - e_{i,t-1})$, is correlated by construction with the differenced lagged dependent variable, $(y_{i,t-1} - y_{i,t-2})$. Instead of assuming the explanatory variables are uncorrelated with the error term for all leads and lags, I allow for the possibility of simultaneity and reverse causation. The assumption of weak exogeneity allows current explanatory variables to be affected by past and current realizations of the dependent variable, but they cannot be affected by future innovations see Roodman 2006).

The consistency of the GMM estimator depends on whether lagged values of the explanatory variables are valid instruments in the regression. I address this issue by considering specification tests suggested by Arellano and Bond (1988) and Arellano and Bover (1995). The first is a Sargan test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the moment conditions used in the estimation process. Failure to reject the null hypothesis gives support to the model. The second test examines the hypothesis that the error term $u_{i,t}$ is not serially correlated. I test whether the differenced error term (that is, the residual of the regression in differences) is first, second, and third-order serially correlated. First-order serial correlation of the differenced error term is expected even if the original error term (in levels) is uncorrelated, unless the latter follows a random walk. Second-order serial correlation of the differenced residual indicates that the original error term is serially correlated and follows a first order or higher moving average process. If the test fails to reject the null hypothesis that there is no second-order serial correlation, I conclude that the original error term is serially uncorrelated and so I can use the corresponding moment conditions. To check for the validity of our model specification, I perform additional regressions with varying specifications. As the overall pattern of our results is untouched by specification changes, I only report results excluding deterministic time dummies.

a. Results

As shown in column one and three of Table 2, removing the controls does not alter my main conclusions, so in this discussion I will focus only on the four “core” explanatory variables for the current account balance. The first important point is that all of the specification tests support the system-GMM estimator. The test of over-identifying restrictions (Sargan test) cannot reject the null hypothesis that the instruments are uncorrelated with the error term. Moreover, serial correlation tests do not reject the hypothesis that the differenced error term is not second- or third-order serially correlated (while rejecting that it is not first-order serially correlated). Thus the specification tests support the use of lags of the explanatory variables as instruments for estimation.

Not surprisingly given the persistence of current account imbalances in the eurozone, the lagged current account explains much of the variation in the current account balance. Government savings has a fairly strong, significant effect on current accounts, which is in line with the literature. For every 1 percent increase in the government deficit, the current account decreases by .18 percent *ceteris paribus*. While this is far from a one-for-one relationship, it is significantly different from zero, and so the Ricardian equivalence theorem can be rejected. Relative per-capita income is also significant. A 1 percent increase in the log of per capita income relative to Germany yields a 6 percent increase in the current account *ceteris paribus*. This means that as countries catch up and have more per capita income, they run more positive current account balances. Finally the competitiveness hypothesis is supported. The log of the real exchange rate is very significant. A 1 percent increase in the real exchange rate results in a decrease in the current account by 8.2 percent. This means that if a country’s real exchange rate appreciates (and so the country is less competitive), the current account deficit increases. Thus, I

am confident in accepting that the twin deficit hypothesis explains a significant portion of the current account balances in the eurozone, although far from all of it. The competitiveness hypothesis and the catch-up hypothesis can also be accepted by this regression, although with less certainty.

Table 2: Dependent Variable: Current Account / GDP

Explanatory Variable	System-GMM (rubust, small, L8-20)	System-GMM (rubust, small, L8-20)	System-GMM (rubust, small, L8-20)
Lagged Current Account	0.4693 (.1059)***	0.4964 (.1137)***	0.5200 (.1048)***
Government Savings / GDP	0.1944 (.0969)*	0.1962 (.0976)*	0.1817 (.0963)*
Log of Real Exchange Rate	-4.9130 (4.1751)	-7.4103 (3.6114)*	-8.2061 (3.4967)**
Relative per Capita Income	8.7301 (2.4045)***	7.5849 (2.3481)***	5.9818 (2.6452)**
Fixed Investment / GDP	-0.2509 (.1671)	-0.3403 (.1397)**	-0.3774 (.1418)**
Real GDP Growth	0.0724 (.0921)	0.0700 (.0914)	
Age Dependency Ratio	0.0739 (.0968)	0.1354 (.1039)	
Unemployment	0.0155 (.1446)		
Population Growth	-1.1773 (.8441)		
Net Foreign Assets	0.1968 (.2169)		
Join	0.4688 (.9646)		
Constant	18.0795 (15.4312)	30.9807 (12.9049)**	40.2915 (15.9423)**
Arellano-Bond test in first differences:			
AR(1):	z = -2.87 Pr > z = 0.004	z = -2.82 Pr > z = 0.005	z = -2.89 Pr > z = 0.004
AR(2):	z = -0.19 Pr > z = 0.850	z = -0.14 Pr > z = 0.891	z = -0.07 Pr > z = 0.945
Sargan test of overid	chi2(490)=450.2 Pr>chi2=0.725	chi2(490)=459.9 Pr>chi2=0.738	chi2(490)=463.5 Pr>chi2=0.799
Hansen test of overid	chi2(490)=0.86 Pr > chi2 = 1.00	chi2(490)=5.58 Pr > chi2 = 1.00	chi2(490)=5.51 Pr > chi2 = 1.00
Difference-in-Hansen tests of exogeneity of instrument subsets:			
Hansen test excluding group:	chi2(490)=.86 Pr > chi2 = 1.0	chi2(490)=5.6 Pr > chi2 = 1.0	chi2(434)=5.51 Pr > chi2 = 1.0
Difference (null H=exogenous):	chi2(56)=0.00 Pr > chi2 = 1.0	chi2(56)=0.00 Pr > chi2 = 1.0	chi2(56)=0.00 Pr > chi2 = 1.0

VII. VAR Analysis

Sims (1980) made a revolutionary contribution to non-structural empirical modeling by creating vector auto-regressions (VARs). Critically, the VAR methodology treats all relevant variables as endogenous. Thus, it uniquely allows the interrelationships among the variables to be examined without imposing a priori restrictions of exogeneity. In contrast, the system-GMM model I used last section required weak exogeneity. Additionally, it offers econometricians powerful new analytical tools, the most popular of which are the impulse response functions (IRFs). IRFs are used to track the responses of a system's variables to impulses of the system's shocks. However, the VAR methodology is not without criticisms. They are thought to be overparameterized and inefficient; because they impose no theoretical restrictions, they require the estimation of very large numbers of parameters. They are also criticized as atheoretical because early models were used for forecasting rather than interpretation. Nonetheless, they are one of the most prevalent empirical techniques. In an overview of the literature, Stock and Watson (2001) concluded that VARs successfully capture the rich interdependent dynamics of data. However, they stressed that their structural implications are only as sound as their identification schemes.

I will employ a reduced form recursive VAR. Reduced form VARs expresses each variable as a linear function of its own past values, the past values of all other variables being considered, and a serially uncorrelated error term. My choice of variables is influenced by my above discussion for the system-GMM regression as well as Kim and Roubini (2008). Like Kim and Roubini, I will include the variables current account balances as a percent of GDP (CA), government savings as a percent of GDP (GOV), log of real effective exchange rate (REER), log

of real GDP growth rate (RGDP), and the real 3-month interest rate (RI) in quarterly form. However, I will also include the log of gross fixed capital investment as a percent of GDP (GFCF). Without including GFCF, many of the IRF responses were in the direction opposite predicted by theory. Since Kim and Roubini's VAR model was for the US and did not include the recent global economic crisis, it is reasonable that eurozone countries—especially those in the periphery—would be especially responsive to gross fixed capital investment.

Thus, my VAR involves six equations, one for each of the variables I include. For reasons discussed in the Lag Testing section, each variable in each equation will also have two of its lags. The first equation is RGDP as a function of past values of RGDP, GOV, GFCF, RI, REER, and CA. The second is GOV as a function of GOV, RGDP, GFCF, RI, REER, and CA. The remaining four equations follow this same formula. Each equation is estimated by ordinary least squares (OLS) regression. Estimation of each equation by OLS produces residuals that are uncorrelated across equations. The errors terms in these regressions are the unpredicted movements in the variables, after taking its past values into account. If the different variables are correlated with each other, then the error terms in the reduced form model will also be correlated across equations. Like Kim and Roubini (2008), my VAR is recursive. This means that I impose restrictions on which variables affect which others. My VAR is ordered as (1) RGDP (2) GOV, (3) GFCF, (4) CA, (5) RI, and (6) REER. Not surprisingly, a major criticism of the VAR methodology is the arbitrary choice of orderings which can greatly affect the output. Thus I will justify and discuss my orderings in greater depth in the IRF section.

According to *Multiple Time Series Models*, written by Brandt and Williams (2007), the steps to building a successful VAR model are: testing for unit roots, testing lag length, specifying and estimating the VAR, testing Granger Causality, and finally conducting and interpreting IRFs.

To ensure that my conclusions are supported by my identification, I will follow these outlined steps for each country. Thus, using data from 1994q1-2010q4 for Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, and Spain, I will build 6 equation models for the variables RGDP, GOV, GFCF, CA, RI, and REER and their lags. However, only Italy, Netherlands, France, and Finland have all observations.

a. Testing for Unit Roots

In the absence of a unit root (stationary), the series fluctuates around a constant long-run mean, which implies that the series has a finite variance that does not depend on time. On the other hand, a unit root (non-stationary) series has no tendency to return to a long-run deterministic path which implies that the variance of the series is time dependent. Non-stationary series suffer permanent effects from random shocks and thus the series follow a random walk. If the series is non-stationary and the first difference of the series is stationary, the series is said to contain a unit root. I will use the most common method to test for the presence of unit roots: the Augmented Dickey-Fuller (ADF) tests (see Dickey and Fuller, 1979). The null of the ADF model is that $\alpha=0$ and the alternative is that it is $\alpha<0$. This is tested by the ADF equation:

$$\Delta y_t = u + \beta_t + \alpha y_{t-1} + \sum_{i=1}^k c_i \Delta y_{t-i} + \varepsilon_t$$

where Δ denotes the first difference, y is the time series being tested, t is the time trend variable, and k is the number of lags which are added to the model to ensure that the residuals, ε , are white noise. As will be discussed more in the following section, the Schwarz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) are used to determine the optimal lag length or k . Non-

rejection of the null hypothesis implies that the series is non-stationary; whereas the rejection of the null indicates the time series is stationary. Thus, a criticism of the test is its sensitivity to lag length.

It is important to remember that there are real costs to differencing series. The presence or absence of unit roots helps to identify some features of the underlying data generating process of a series. Thus, removing the unit root by differencing removes valuable long-run information about the series'. As a result, in macroeconometrics unit root tests are typically performed using logs (see Stock and Watson, 1991). As shown in Table 3, when the variables RGDP, REER, and GFCF are in log form, the null of a unit root can be rejected. The remaining variables, as percentages of GDP, are stationary without applying a log transformation. Therefore, the use of log transformation for RGDP, REER, and GFCF in the VAR was justified on two grounds. It was more appropriate for model specification and it solved the problem of stationarity. For reasons discussed in next section, two lags were included in each test.

Table 3: Unit Roots

	CA	RGDP	GOV	REER	GFCF	RI
Austria	-8.26***	-6.47***	-11.42***	-3.31**	-10.66***	-3.53**
Belgium	-7.51***	-6.44***	-21.11***	-3.09*	-9.22***	-3.53**
Germany	-3.80**	-4.92***	-5.88***	-3.22*	-7.59***	-3.53**
Greece	-5.75***	-3.040	-6.35***	-3.78**	-2.391	-3.53**
Finland	-5.95***	-5.60***	-4.41***	-3.76**	-5.90***	-3.53**
France	-4.71***	-5.10***	-13.26***	-3.25*	-3.44*	-3.53**
Ireland	-4.25***	-1.338	-7.34***	-3.05*	-2.097	-3.53**
Italy	-7.08***	-5.14***	-8.75***	-4.28***	-4.68***	-3.53**
Netherlands	-4.41***	-5.61***	-3.17*	-3.55**	-6.70***	-3.53**
Portugal	-5.14***	-4.11***	-5.98***	-3.48**	-3.35**	-3.53**
Spain	-3.47*	-4.79***	-4.20***	-3.41*	-3.45**	-3.53**

The above table displays the z-statistic for a Augmented Dickey Fuller Unit Root Test for the variables of interest. The test included a trend and 2 lags. The null hypothesis that there is a unit root in the data can be rejected s performed on the variables of interest. The critical values are -4.11, -3.48, and -3.17 for rejecting the null with 1, 5, and 10 percent respectively.

b. Testing Lag Lengths

It is important to include the correct number of lags in the model. Too many lags could increase the error in the IRFs and forecasts; too few could leave out relevant information. There are, however, information criterion procedures to help arrive at the proper number. These criterions test the improvement to the log-likelihood while penalizing for the additional lags. The most common criterions are the Schwarz's Bayesian information criterion (SIC) and the Akaike's information criterion (AIC). The SBIC issues a larger penalty for additional lags.

I tested each country's VAR model using both of these information criterions for lag orders 1-8. In all cases the SIC picked 2 lags and the AIC picked 2 or 4. I used the likelihood ratio test which could not reject using 2 lags over 4 lags. Finally, I used the LM autocorrelation test to determine if 2 lags were sufficient in the borderline cases. When 2 lags were used, the

tests failed to reject the null hypothesis of no autocorrelation. Since autocorrelation is the main danger of including too few lags and I found no evidence of autocorrelation when I used 2 lags, I will include 2 lags in my VAR model for each country.

c. Estimating VAR

Thus as discussed above, my VAR involves six variables: RGDP, GOV, GFCF, RI, REER, and CA, where RGDP, GFCF, and REER are in logarithm form. Each variable also has two lags. The data is from 1994q1-2011q4 for Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, and Spain. However, only Italy, Netherlands, France, and Finland have all observations. The remaining countries are missing between 2 and 5 years of data. Because the coefficients of the variables in a VAR cannot be interpreted, I do not include the results here. I tested the stability of each VAR. All 11 countries' VARs were stable; each variables' eigenvalue was less than 1.

d. Granger Causality

Granger-causality statistics examine whether lagged values of one variable help to predict another variable. Thus, variable X is said to Granger-cause variable Y if Y can be better predicted using the histories of both X and Y than it can be by using the history of Y alone. Each equation of the VAR is Granger tested. The equation used to test Granger-causality is:

$$Y_t = a_0 + a_1 Y_{t-1} + \dots + a_p Y_{t-p} + b_1 X_{t-1} + \dots + b_p X_{t-p} + u_t$$

Then, testing $H_0: b_1 = b_2 = \dots = b_p = 0$, against $H_A: \text{'Not } H_0\text{'}$, is a test that X does not Granger-cause Y. For example, if the government savings rate does not help predict the current account (and the null cannot be rejected), then the coefficients on the lags of government savings will all be zero in the reduced form current account equation. A rejection of the null implies that the alternative hypothesis of Granger-causality cannot be rejected. However, Granger-causality does not tell how the variables are affected, which is why next section's IRFs are so important. Tables 4 and 5 summarize the Granger-causality results for my six-variable VAR. Because my VAR specification includes more than two variables, I am testing if variable X Granger-causes current account balances after controlling for the remaining variables and their lags. Thus, it tests if variable X can explain the current account balance even after the other variables and their lags have explained as much as they can.

First, it is important to realize that there are three possible relationships between the current account balance and variables RGDP, GOV, REER, RI, and GFCF that the Granger-causality test can reveal. The first is that there may be no evidence of Granger-causality between the variables. The second is that there may be causality in one direction (unidirectional causality). Finally, there may be bidirectional causality in which causation runs from both variables. Table 4 shows the results from the test that variable X Granger-causes the current account balance. If the p-value is significant, we can reject the null-hypothesis that there is no Granger-causality with 90 (*), 95 (**), or 99 (***) percent certainty. Table 5 shows the result of testing that the current account balance Granger-causes variable Y. If the p-value is significant in both tests, then we have bi-directional causality.

Table 4: Does Variable X Granger-Cause Current Account Balances

	RGDP	GOV	REER	GFCF	RI	ALL
Austria	9.39*** (0.002)	0.359 (0.549)	0.153 (0.696)	5.916 (0.015)	6.369 (0.012)	66.763 (0.000)
Belgium	0.370 (0.543)	13.360 (0.000)	19.709 (0.000)	7.015 (0.008)	32.999 (0.000)	112.310 (0.000)
Germany	11.824 (0.001)	2.127 (0.145)	0.767 (0.381)	0.996 (0.318)	11.126 (0.001)	16.842 (0.005)
Greece	26.616 (0.000)	2.330 (0.127)	2.465 (0.116)	3.525 (0.060)	3.432 (0.064)	100.360 (0.000)
Finland	35.901 (0.000)	77.360 (0.000)	0.015 (0.902)	0.103 (0.748)	14.831 (0.000)	140.090 (0.000)
France	2.731 (0.098)	0.189 (0.664)	0.201 (0.654)	0.083 (0.773)	0.107 (0.743)	19.213 (0.002)
Ireland	3.531 (0.060)	3.263 (0.071)	1.254 (0.263)	11.011 (0.001)	9.572 (0.002)	43.918 (0.000)
Italy	13.991 (0.000)	0.068 (0.794)	0.045 (0.832)	23.891 (0.000)	0.687 (0.407)	74.963 (0.000)
Netherlands	2.923 (0.087)	0.877 (0.349)	6.235 (0.013)	8.329 (0.004)	6.029 (0.014)	39.625 (0.000)
Portugal	11.481 (0.001)	0.039 (0.844)	0.172 (0.678)	0.342 (0.559)	0.058 (0.809)	19.100 (0.002)
Spain	0.008 (0.928)	0.024 (0.877)	11.077 (0.001)	34.310 (0.000)	0.510 (0.475)	109.820 (0.000)

The above table displays the chi-sq statistic and (p-value) for the Wald Granger Causality Test. All of the tests are for the CA equation and the variable specified is excluded from the equation. The null is the absence of Granger causality.

Table 5: Does the Current Account Balance Granger-Cause Variable Y

	RGDP	GOV	REER	GFCF	RI
Austria	1.821 (0.177)	1.7668 (0.184)	0.0001 (0.998)	2.98* (0.085)	0.04656 (0.829)
Belgium	9.447*** (0.002)	22.254*** (0.000)	2.0225 (0.155)	14.045*** (0.000)	9.809*** (0.002)
Germany	0.84898 (0.357)	29.153*** (0.000)	0.3409 (0.559)	2.97* (0.085)	3.72* (0.054)
Greece	7.416*** (0.006)	1.8911 (0.169)	0.55501 (0.456)	5.30** (0.021)	1.7804 (0.182)
Finland	3.09* (0.079)	28.466*** (0.000)	2.1108 (0.146)	0.0688 (0.793)	0.1817 (0.670)
France	1.2956 (0.255)	0.90571 (0.341)	10.980*** (0.001)	1.0687 (0.301)	0.40297 (0.526)
Ireland	1.8854 (0.170)	4.43** (0.035)	2.6685 (0.102)	47.622*** (0.000)	1.6644 (0.197)
Italy	2.3367 (0.126)	2.218 (0.136)	0.42586 (0.514)	32.762*** (0.000)	1.5883 (0.208)
Netherlands	2.236 (0.135)	0.00016 (0.990)	2.02 (0.155)	0.0031 (0.956)	16.780*** (0.000)
Portugal	39.661*** (0.000)	2.0181 (0.155)	6.17** (0.013)	7.156*** (0.007)	0.35223 (0.553)
Spain	3.07* (0.080)	1.0069 (0.316)	2.3374 (0.126)	2.0686 (0.150)	5.68** (0.017)

The above table displays the chi-sq statistic and (p-value) for the Wald Granger Causality Test. All of the tests are for the specified variable-equation and the CA balance is excluded from the equation. The null is the absence of Granger causality.

From the tables, we can see that all three relationships occurred and there is no absolute pattern; however, some interesting generalizations can be made. Each country's current account balance seems to be Granger-caused by differing subsets of the five variables. Of note, all of the peripheral countries' current account balances were Granger-caused by real GDP growth and gross fixed capital investment. This supports the conclusion from the Stylized Facts section that their current account balances were fueled by rapid growth and investment inflows. Additionally, all peripheral countries (except Spain) also showed bi-directional causality for these variables, meaning that real GDP and government savings also Granger-caused the current account balance. Surprisingly, government savings and the real effective exchange rate had weaker causal relationships with the current account balance. Spain is the only peripheral country for which the real exchange rate was significant. However, this is not surprising. Spain has the most rigid labor market and has experienced substantial increases in labor costs since adopting the euro, which has greatly eroded the competitiveness of their export sector. Similarly, the real exchange rates in Ireland, Portugal, and Greece are almost significant. Ireland is the only peripheral country for which government savings is significant. This is surprising since Ireland's government spending has been fairly conservative. This goes against the common theme that the peripheral countries are suffering because of declining competitiveness.

The pattern is quite different for the core countries. Germany, France, and Finland are most affected by real GDP and government savings. This is not surprising; these countries have yet to run balanced budgets since joining the eurozone. Both Germany and France have run very pro-cyclical government balances and have been frequent offenders of the Stability and Growth Pact while Finland has run large government surpluses. This relationship also runs the opposite direction and so the current account balance granger-causes government savings. However, it is

impossible to say if this is a positive or negative relationship using only Granger-causality tests. Surprisingly, the real exchange rate has a significant relationship with the current account in non-peripheral countries. The real exchange rate Granger-causes the current account balance in the Netherlands and Belgium. It is surprising that this relationship is significant for these countries since their unit labor costs and current account balances have been in line with EU average. Since REER was not significant in peripheral countries, it suggests that non-eurozone countries could be affected by the changes to their competitiveness.

e. Impulse Response Functions

Finally, we can examine the IRFs. IRFs trace out the response of current and future values of each of the variables to a one unit increase in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. The implied thought experiment of changing one error, while holding the others constant, makes most sense when the errors are uncorrelated across equations, so impulse responses are typically calculated for recursive VARs. Thus, I used a recursive VAR; this specification generates IRFs by imposing restrictions on which variables affect which other variables. Recursive VARs constructs the error terms in each regression equation to be uncorrelated with the error in the preceding equations. Orthogonalising the VAR's shocks is required so that the shocks tracked by IRFs are uncorrelated. Cholesky decomposition, which I implemented, is a popular method of orthogonalising the reduced form shocks. Cholesky decomposition achieves orthogonalisation by imposing a recursive structure on the contemporaneous relationships of the variables. This is done by thoughtfully including some contemporaneous values as regressors.

My VAR is thus ordered as (1) RGDP (2) GOV, (3) GFCF, (4) CA, (5) RI, and (6) REER, where the contemporaneously exogenous variables are ordered first. If GFCF is removed, my VAR is ordered identically to Roubini and Kim (2008). In the first equation my recursive VAR, RGDP is the dependent variable and the regressors are lagged values of all six variables. In the second equation, the GOV is the dependent variable and the regressors are lags of all six variables and the current value of the RGDP. This pattern continues for the remaining four equations. As discussed by Kim and Roubini, it is crucial to include RGDP first in the ordering. Since the data is quarterly, including the contemporaneous RGDP in each equation controls for business cycle effects. By ordering GOV second, the exogenous government deficit shocks are extracted by conditioning on the current and lagged RGDP and all other lagged variables. This is important because the government budget is likely to be endogenously affected by the current level of economic activity within a quarter. The ordering for the remaining four variables is not important. I generated IRFs for different orderings of the variables and little changed as long as RGDP was first. However, the IRFs are sensitive to lag lengths. When one lag was added, the responses were not stable. When more than two lags were added, the responses oscillated around zero and would switch from positive to negative effects from quarter to quarter.

Tables 6a-d below display the effect of an unexpected one percentage point increase in the variable on the left-side on the current account balance, as it works through the recursive VAR system over 15 quarters. Also plotted are ± 2 standard error bands, which yield an approximate 95% confidence interval for each of the impulse responses. These estimated impulse responses show patterns of persistent common variation.

First I will discuss country-specific results and then generalizations from the IRFs across countries. I will begin with Table 6a, which has IRFs for Austria, Belgium, and Finland. For

Austria, only RGDP has an effect on the current account that is significantly different from zero. The response peaks after 3 quarters at -1.7 and then returns to zero by the 6th quarter, meaning that a 1 percent positive shock to RGDP increases the current account deficit by 1.7 percent. For GOV, GFCF, IR, and REER, the anticipated effect on the current account is at least partially in the correct direction (positive, negative, positive, and negative respectively), but the effect is not significantly different from zero. Belgium is similar. RGDP peaks at 4 quarters and slowly approaches zero. Its remaining variables also bare the correct signs, although they are also insignificant. The large standard error bands on the impulse response functions are likely due to missing data. Austria and Belgium are missing 5 years of data. GOV and RGDP are significant for Finland. GOV peaks at 1 for the 3rd quarter and returns to zero by the 5th quarter. RGDP has a smaller effect, although it is negative and significantly different from zero after 6 quarters.

Table 6b has IRFs for France, Germany, and the Netherlands. GOV and RGDP are significant for France; however, the responses are much smaller. GOV peaks at .3 after 3 quarters and returns to zero after 10 quarters. For Germany, REER is significant; it peaks at -.5 after 2 quarters, meaning that if Germany weakens its REER by 1 percent, its current account could become .5 percent more negative. While not significant, GOV has a negative impact on the current account in Germany; however, this is not wholly unexpected because Germany ran persistent current account deficits and current account surpluses for a decade. Finally, GOV and RGDP are significant in the Netherlands. A 1 percent shock to GOV increases the current account surplus by .8 percent immediately. While initially positive, by the 3rd quarter, a 1 percent increase to RGDP increases the current account deficit by -.5 percent. For all three countries, the non-significant impulses generally agree with theory, but are not significantly different from zero. In summary, RGDP and GOV appear to be the factors driving current accounts in core countries.

On average, a one percent increase to RGDP increases the current account deficit by about .75 percent on the 3rd quarter and returns to zero by the 6th quarter. GOV is not always significant, but it averages .4 at the 2 quarter.

Table 6c has IRFs for Greece, Ireland, and Italy. Although not with much margin, all the variables except IR are significant for Greece. It predicts that after a 1 percent increase in GOV, the current account deficit would shrink by .8 percent after 2 quarters. While initially positive, a 1 percent increase in GFCF is expected to decrease the current account by 1 percent after 4 periods. Also, it predicts a .1 percent weakening of the current account in response to 1 percent weakening of the REER. Finally, RGDP is expected to have a -.8 percent impact after 2 quarters. For Ireland only GFCF is significant. It predicts that a 1 percent increase to GFCF would increase the current account deficit by .6 percent. Italy's only significant impulse is GOV. It finds that a 1 percent increase to GOV increases the current account by 2 percent.

Table 6d shows the IRFs for Portugal and Spain. For Portugal, GOV, GFCF, and REER are significant. GOV peaks at .7 after 2 quarters; GFCF peaks immediately at -1 percent; REER peaks immediately at 1 percent. All responses follow the sign predicted by theory except for REER. For Spain, GOV, GRCF, and RGDP are significant. A 1 percent increase in GOV predicts a .5 increase in the current account at 4 months. GFCF peaks at -.5 after 4 months and is slow to approach zero. RGDP peaks immediately at -.5. In summary, the peripheral countries IRFS are more diverse than core countries. However, a few generalizations can be made. GFCF and GOV (which averaged -.5 after 4 quarters and .3 after 3 quarters) drive the current account balances of the countries that have been identified as running strong construction booms prior to the financial crisis (Ireland and Spain). Also, GOV (which averaged .5 percent after 2 quarters) is significant for the countries that required bailouts. RGDP (which averaged -.7 percent after 2

quarters) is significant for both boom and bailout countries. Together, this suggests that mounting fixed investment and growing real GDP fueled the current account deficits when construction booms were present, and pro-cyclical fiscal policy fueled the current account deficits in the countries with the weakest public finances.

Table 6a: The Responses of the Current Account to GDP Ratio to an Impulse of a Specified Variable

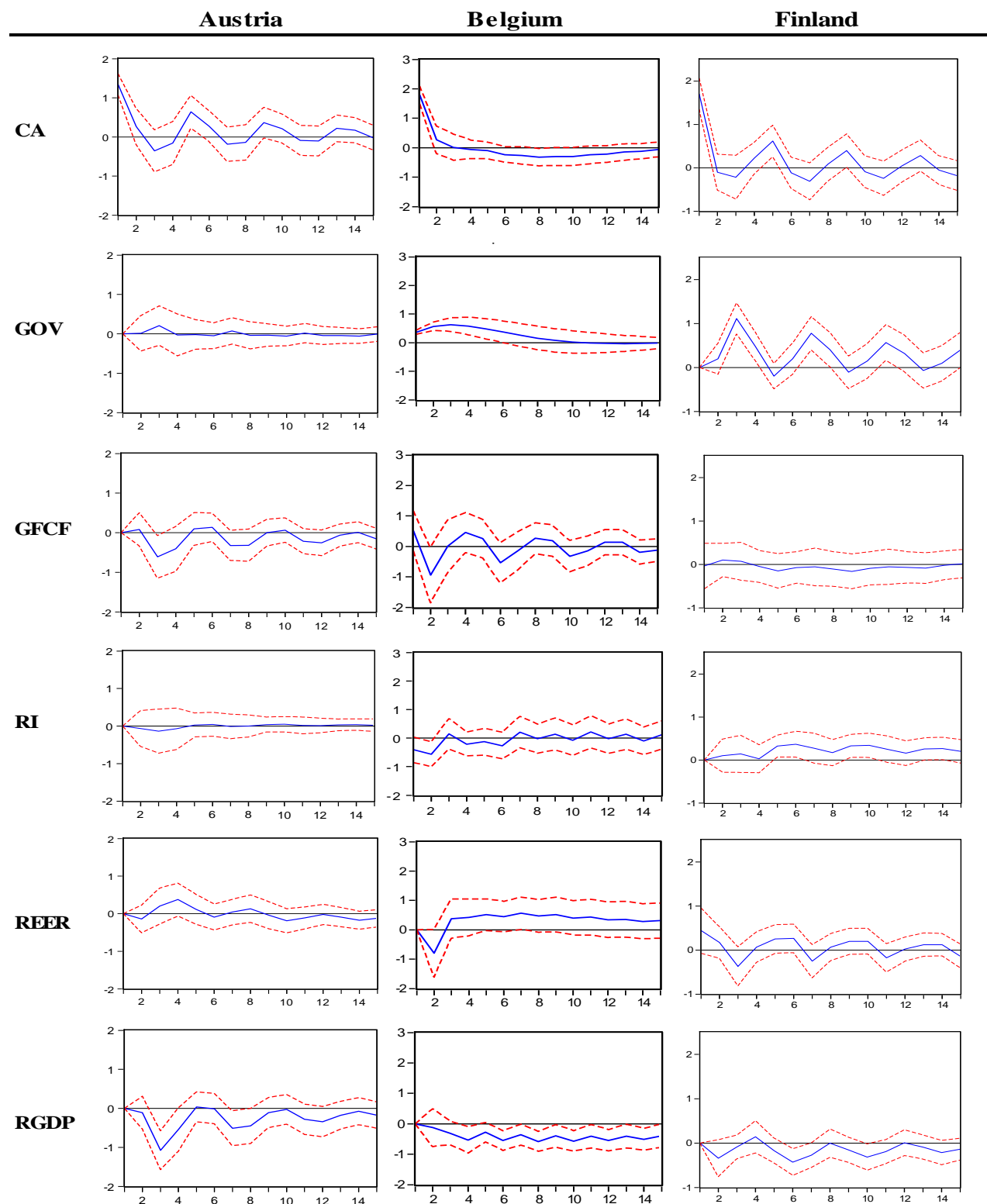


Table 6b: The Responses of the Current Account to GDP Ratio to an Impulse of a Specified Variable

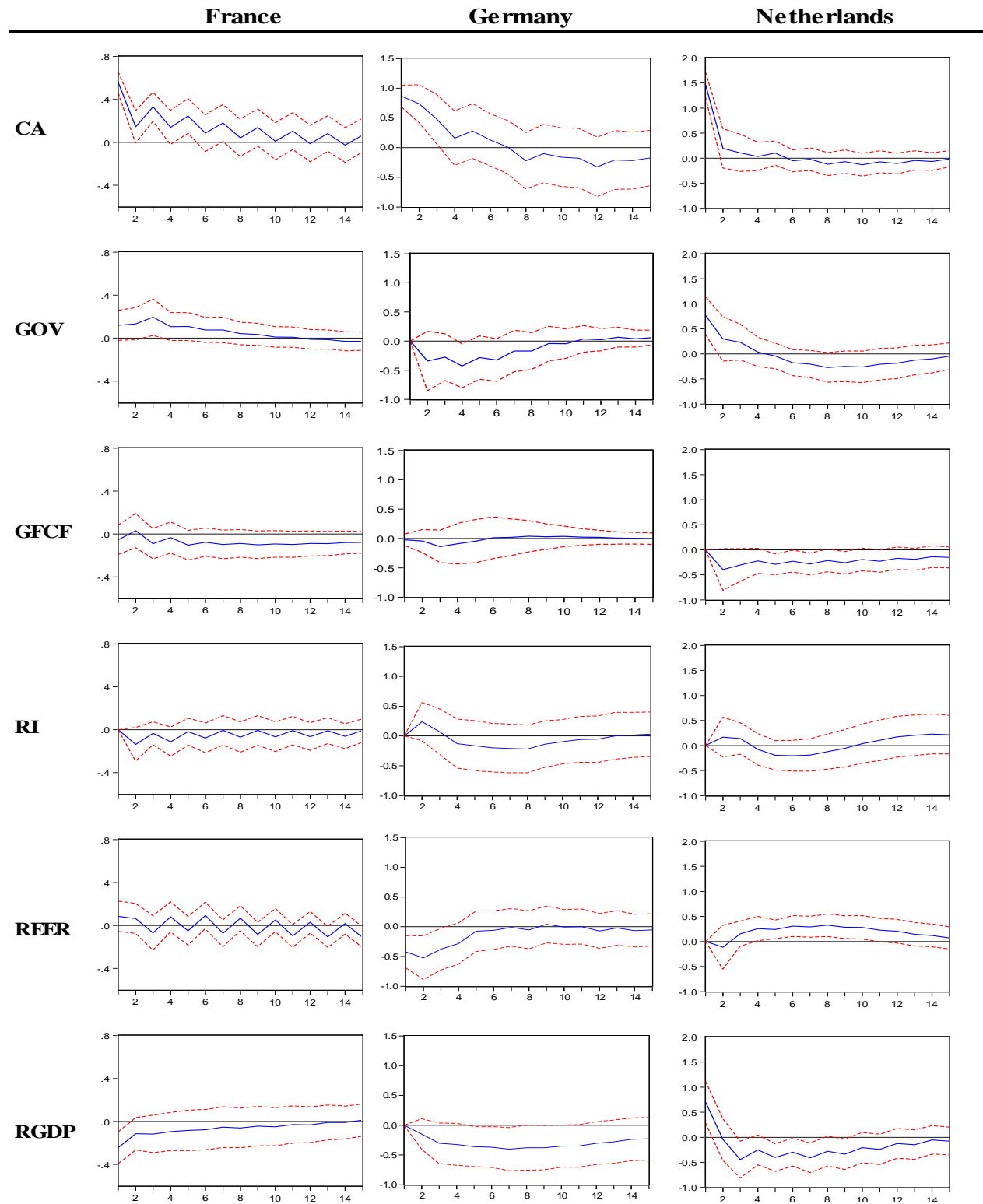


Table 6c: The Responses of the Current Account to GDP Ratio to an Impulse of a Specified Variable

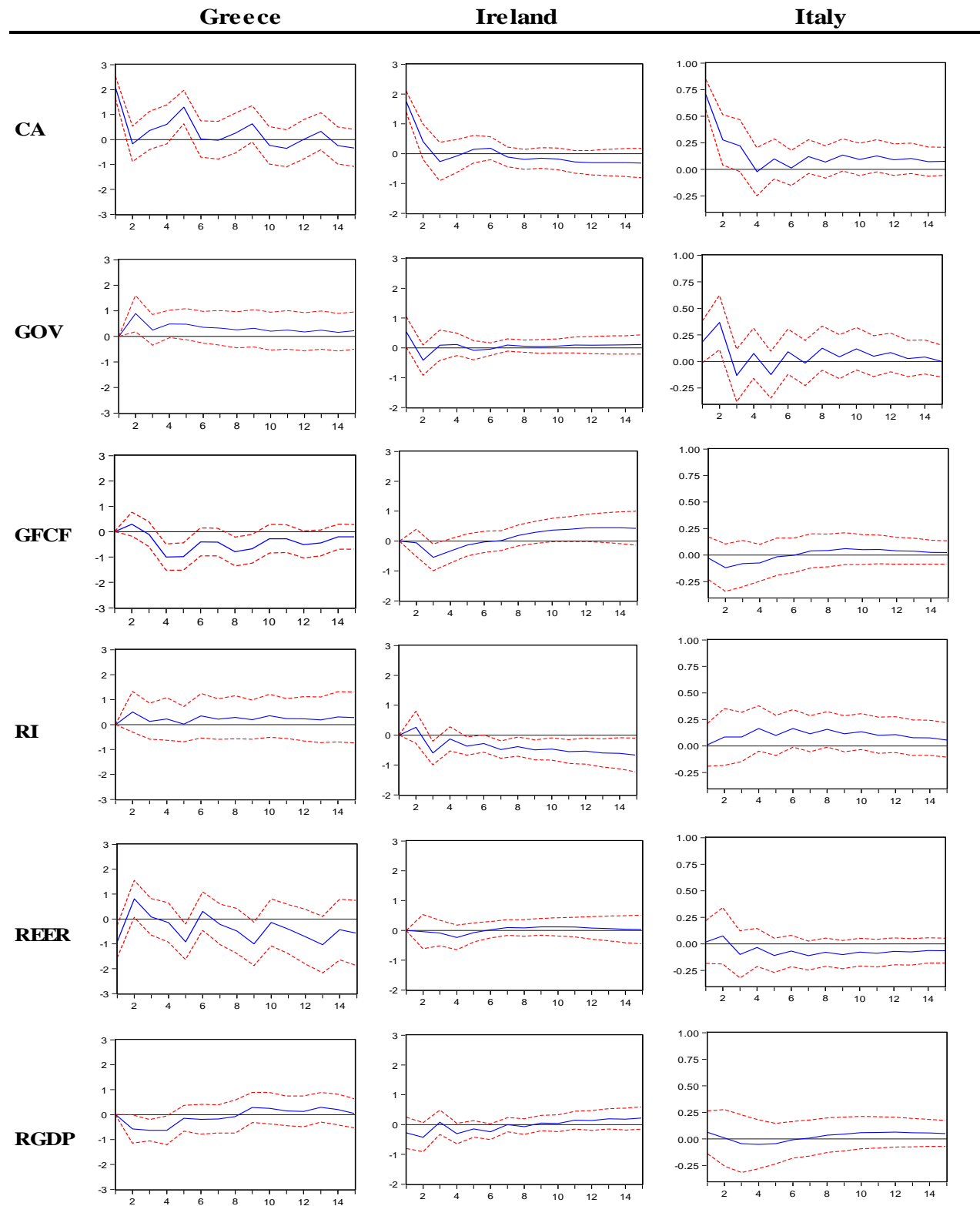
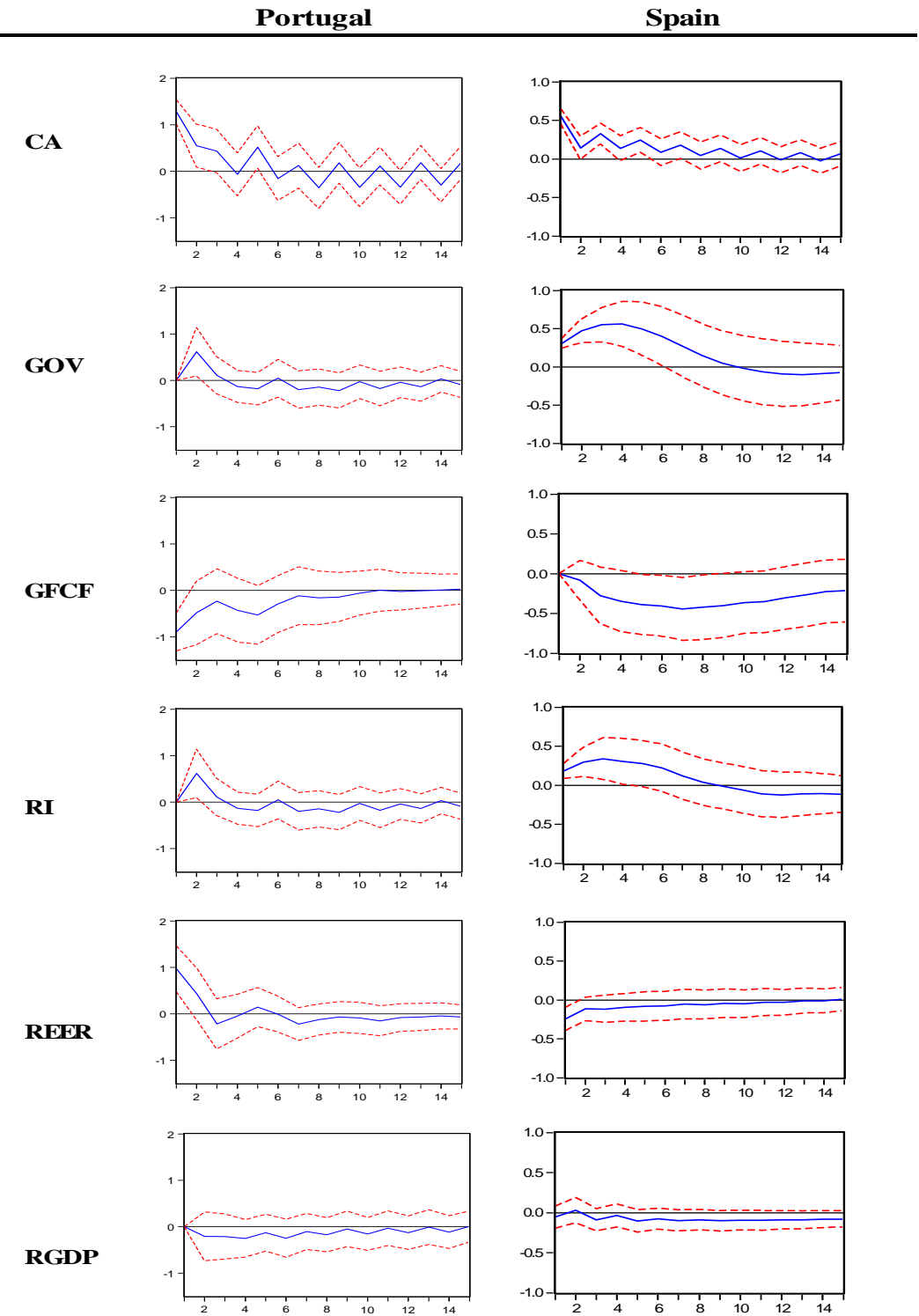


Table 6d: The Responses of the Current Account to GDP Ratio to an Impulse of a Specified Variable



VIII. Overall Data Analysis

Both the system-GMM and VAR models agree on the direction government savings (positive), the real exchange rate (negative), real GDP growth (negative), and gross fixed capital investment (negative) effects the current account. However, the system-GMM finds support for the twin deficit hypothesis, the competitiveness hypothesis, and the catch-up hypothesis, while the IRFs from the VARs are more discriminating. Using both of these models, I can extrapolate that a 1 percent increase to government savings results in about a .18 percent increase to the current account balance for Belgium, Austria, the Netherlands, and Italy, which peaks after 3 quarters and returns to zero after 4 quarters. A 1 percent increase in the real exchange rate results in about an 8 percent decrease to the current account balance for Spain, Germany, and Portugal, which peaks after 3 quarters and returns to zero after 5 quarters. Real GDP growth has a significant effect on the current account balances of Austria, France, the Netherlands, and Greece. Finally, a 1 percent increase to gross fixed capital formation results in about a .37 percent decrease to the current account for Greece, Ireland, Portugal, and Spain, which peaks after 2 quarters and returns to zero after 4 quarters. Thus, GFCF, which proxies the construction boom, is the most important determinant of the current account balance for peripheral countries. From the Stylized Facts sections, we also know that these countries were hardest hit by the 2007 financial crisis, suggesting that current account deficits resulting from sector-specific booms are harmful and should be prevented or tightly controlled whenever possible. Government savings is the most significant determinant for core countries; however, they fared relatively well during the financial crisis. Thus, even though I find evidence of the twin deficit hypothesis, it does not appear to indicate underlying domestic distortions. Possibly, this could be because the eurozone

already imposes limits on the size of its member countries government deficits (see Filipek and Schreiber, 2010). The catch-up and competitiveness hypothesis are more challenging to evaluate. As discussed in the Stylized Facts section, growth expectations were almost certainly overly optimistic prior to 2007, which would represent a domestic distortion; however, my models do not directly capture growth forecasts, so I cannot test for this distortion. This issue should be explored in further research. According to my VARs, Portugal, Spain, and Germany's current account balances have been influenced by shifts in the real exchange rate, which proxies competitiveness. Also as discussed in the Current Account Determination section, countries that are running current account deficits because they are relatively less competitive bear the painful costs of adjustment. Thus, in order to restore competitiveness to the eurozone, Portugal and Spain alone must suppress their wage growth and undergo painful deflation. Stockhammer (2011) argues that the EMU must correct this free-rider problem by imposing a wage pact that will prevent predatory wage setting by surplus countries (especially Germany) that can free-ride on the necessary adjustments made by deficit countries. However, Stockhammer stresses surplus countries' "predatory intent," which the variables I have included in my regressions cannot test for. Also, the models I chose to implement cannot determine if Spain's falling competitiveness is influenced by Germany's rising competitiveness or if it is only an effect of their own wage policies. This hypothesis should also be explored in greater depth. One possibly would be to use a global vector auto-regression that links the trade patterns and real exchange rates between eurozone members; this could provide a better understanding of how shifts in competitiveness transmit through the eurozone.

IX. Conclusions

In the debate on global imbalances, the eurozone countries did not receive much attention prior to the 2007 financial crisis, even by EU officials. The net government savings of member countries was observed much more rigorously by the EMU through the Stability and Growth Pact; however, at the onset of the crisis, investors first lost confidence in countries that had massive accumulations of foreign debt, suggesting that investors view the current account balance as an important indicator of financial health in the eurozone. While the divergences have since shrunk, it is important to determine what caused them and to prevent their resurgence. In this paper, I trace the imbalances using a system-GMM dynamic panel and country-specific time-series VARs; both models agree on the direction government savings (positive), the real exchange rate (negative), real GDP growth (negative), and gross fixed capital investment (negative) effects the current account. However, the system-GMM finds support for the twin deficit hypothesis, the competitiveness hypothesis, and the catch-up hypothesis, while the VARs are more discriminating. Most notably, the system-GMM model finds that for every 1 percent increase in government savings, *ceteris paribus*, the current account balance will increase by .18 percent; this result is in line with the literature, but dramatically lower than predicted by the Mundell-Fleming model. Further, the countries for which this relationship was strongest, according to the country-specific VARs, fared the best during the 2007 crisis; this suggests that government savings is not causing harmful current account imbalances. Thus, as long as the Stability and Growth Pact continues to monitor eurozone public finances, the government budget balance should not be used to correct imbalances in the current account. Both the system-GMM and VARs found evidence that a 1 percent increase to gross fixed capital investment results in a .7 percent decrease to the current account for the countries that fared the worst during the crisis.

This suggests that the rising current account deficits in Ireland, Greece, Spain, and Portugal that were caused by a boom in their construction sector reflected harmful domestic distortions. Further, their sector-specific growth generated tremendous windfall revenues that hid weaknesses in their public sector. While the crisis ended these booms, as economic conditions normalize, it is imperative that peripheral countries monitor sector-specific growth to prevent their resurgence. Also, the Stability and Growth Pact should monitor windfall revenue more closely; net government savings is an insufficient measure to identify weaknesses in the public sector. While my system-GMM and VARs find evidence of the competitiveness hypothesis and catch-up hypothesis, they could not detect if the resulting current account imbalances emerged naturally or signaled harmful structural imbalances; thus, more research is needed. In summary, my results have significant implications for macroeconomic policy coordination and surveillance in the eurozone. Essentially, while a generic pact that blindly restricts all current account deficits and surpluses would do more harm than good, a pact that monitors countries' current account imbalances (especially deficits) for harmful underlying distortions (especially sector-specific booms and pro-cyclical fiscal policy) would be beneficial since it would minimize the resurgence of destructive current account imbalances.

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